



Fauna of India

HOMOPTERA : APHIDOIDEA

PART 4

**SUBFAMILIES : PHLOEMYZINAE
ANOECIINAE AND HORMAPHIDINAE**

A. K. GHOSH

Aphidoidea forms one of the most important group of phytophagous insects because of their polymorphism, host alternating-heteroecious behaviour, reproductive habits and above all for their role as largest group of insect vectors of plant viruses. The Fauna of India and the adjacent countries, in this group, constitutes about 16% of the world fauna, including a large number of rare, endemic species. However, no consolidated account of Indian aphids was so far available and the present work was started in 1976 and has been so planned as to be published in several parts. The first part published in 1980, deals with an introductory chapter on Aphidoidea leading to subfamily Chaitophorinae. The second part deals with subfamily Lachninae and the third part deals with subfamily Pemphiginae. This fourth part deals with subfamily Hormaphidinae besides two other related subfamilies Phloemyzinae and Anoeciinae. The entire subfamily is expected to be covered under at least eight separate parts. Besides, taxonomic accounts, information on host plant association, association with ants, natural enemies of aphids, distribution etc., are also provided in these parts.

THE FAUNA OF INDIA
AND
THE ADJACENT COUNTRIES

HOMOPTERA
APHIDOIDEA

Part 4

SUBFAMILIES PHLOEMYZINAE
ANOECIINAE AND HORMAPHIDINAE

By

A. K. GHOSH

Zoological Survey of India, Calcutta



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EDITOR'S PREFACE

'Aphidoidea' perhaps form the single largest group of insects of economic importance in a global scale and recent publications indicate continuously growing interest of biologists, virologists, plant physiologists and taxonomists to investigate into several aspects of these soft bodied homopteran group. Some of the subfamilies of Aphididae are believed to have originated in Southeast Asia, and in the present volume, one such subfamily viz. Hormaphidinae, besides two other related subfamilies, Phloemyzinae and Anoeciinae have been dealt by Dr. A. K. Ghosh, who has gained undisputed reputation through the earlier three printed parts under this series (1. Subfamily Chaitophorinae, 1980 ; 2. Subfamily Lachninae 1982 ; 3. Subfamily Pemphiginae 1984) and more than 150 research papers published since 1958. In the present volume, a total of 65 species, out of a world fauna of 216, belonging to three subfamilies and 27 genera have been dealt. The fauna includes all available taxa known from India and its adjacent countries viz., Bhutan, Nepal, Pakistan and Sri Lanka and Bangladesh (no published record or material from Burma was however available). 'The Fauna of India : Aphidoidea' is expected to be covered under eight parts and the present volume forms Part 4, under the title. Considering the long-felt need of such a treatise from Indian region, I am sure aphidologists will join me in expressing deep sense of appreciation for this yet another significant contribution by Dr. Ghosh, towards our knowledge of Aphidoidea.

March, 1986
Calcutta

B. K. TIKADER
Director
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AUTHOR'S PREFACE

Three subfamilies, Phloemyzinae, Anoeciinae and Hormaphidinae, dealt in the present volume form a natural group of aphid taxa. At least two of the three subfamilies viz. Anoeciinae and Hormaphidinae are fairly well represented in the region. Of the two genera of Anoeciinae, (40 species from the World) members of one genus, *Aiceona* Takahashi, live on Lauraceae in Southeast Asia and is represented only by endemic species (10), while the other genus *Anoceia* with a much wider distribution range in holoarctic region, is represented by 6 species. The members of the subfamily Hormaphidinae (175 species from the World) mostly occur in Southeast Asia and is represented in the region by 48 species under 24 genera and three tribes. The subfamily Phloemyzinae has a wide distribution and presents a rather confusing picture at the species level and is known by only one species from the region. This volume, as such, deals with three subfamilies, 27 genera and 65 species of aphids. It will be apparent from the present volume that much of the biological information remain far from being complete and detail investigation on the biology should be taken up by researchers to fill up the gaps.

The material for the present study originate from several sources. I would like to express my most sincere thanks for the generous help received from Dr. V. F. Eastop and Dr. R. L. Blackman, British Museum (Natural History), London, Late D. Hille Ris Lambers, Bennekom, The Netherlands, Dr. S. Aoki, Rissho University, Saitama Pref., Japan, Dr. S. Akimoto, Emtomological Institute, Hokkaido University, Japan, Dr. Masato Sorin, Kogakkan University, Mie-kon, Japan, Dr. (Mrs.) Louise M. Russell and Dr. Maniya Stoetzel, USDA, ARS, U.S.A., Dr. S. Chakrabarti, Department of Zoology, University of Kalyani, India, Dr. D. Raychaudhuri and Dr. Basant K. Agarwala, University of Calcutta, Dr. L. K. Ghosh, Zoological Survey of India, Calcutta and Dr. S. Kanakaraj David, 22 Kamaraj Avenue, Madras.

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A. K. GHOSH
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ABBREVIATIONS

The following abbreviations have been used in the text : BMNH : British Museum (Natural History), London, England ; CIE : Commonwealth Institute of Entomology, London, England ; CU : University of Calcutta, India ; DHR: : D. Hille Ris Lambers, The Netherlands ; Hokk. Univ. : Hokkaido University, Sapporo, Japan ; ht2 : second segment of hind tarsus ; KU : Kalyani University, Kalyani, India ; p.t. : Processus terminalis ; u.r.s. : Ultimate rostral segment ; ZSI : Zoological Survey of India, Calcutta, India.

INTRODUCTION

The subfamilies, Anoeciinae and Hormaphidinae form a natural sequence of three groups of aphids, connecting Greenideinae at one end and Pemphiginae at the other end.

The subfamily PHLOEMYZINAE is represented by a single genus and one definitely identifiable species on *Populus*. In the region, it has only been known from Pakistan (Habib and Ghani, 1970), although the host *Populus ciliata* is widely distributed in other areas of Northwest Himalaya.

The subfamily ANOECIINAE contains two genera and 16 species in the region under study and most of the species have been recorded during last 20 years. Twelve species, including all the 10 species of *Aiceona*, out of a total of 16 species are endemic in origin and most of the species are restricted to the temperate hill regions of the area. A number of species are also recorded to produce gamic forms.

The first record of HORMAPHIDINAE from the Indian region was published by Buckton (1893) as *Oregma bambusae* from *Bambusa arundinacea* in Dehra Dun, which has later been considered under *Astegopteryx bambusae* (Buckton) comb.n., by Doncaster (1966). Since then, specially during last 35 years, a large number of species of Hormaphidinae have been reported from Indian region, now totalling 48 species under 24 genera and three tribes, of which as many as 27 species and 5 genera are described as new from the region, showing a high percentage of endemism. Out of 48 species, only five species are known from southern India, while the rest are known from northern hills or foothill areas. The recent record of the *Hamamelistes*, with oviparae of *miyabei*, has extended the range of distribution of the taxa and forms only representative record of Hormaphidini from the entire region. The occurrence of most of the species in the northern region is attributable to availability of host plants and congenial biological conditions.

No comprehensive account of Hormaphidinae of the region has been published upto now ; Raychaudhuri, M.R., Ghosh, Pal, A. K. Ghosh (1980) have given account of the group from eastern India and Bhutan. A. K. Ghosh (1985) presented a paper on Systematics, Phylogeny and Distribution of the group on a world scale.

Subfamily PHLOEMYZINAE

Body of medium size, hardly reaching 2.0 mm. Eyes 3-faceted in apterae. Antennae 5-6 segmented, without secondary rhinaria; primary rhinaria ciliated. Abdominal dorsum with large wax plates on posterior tergites. Siphunculi small. Cauda rounded. Subanal plate very slightly indented to almost rounded. Sexual forms, both male and ovipara, with wings.

The subfamily, as considered, is composed of only one genus *Phloemyzus* Horvath, with a single species *passerinii*. The genus was considered under the tribe Pemphigini of subfamily Eriosomatinae by Baker (1920), while Börner (1930) included it under subfamily Thelaxinae. Bodenheimer and Swirski (1957) included it under tribe Mindarini of subfamily Thelazinae and indicated its affinity with Anoeciinae. Eastop (1977) treated Phloemyzinae as distinct subfamily and mentioned that the genus *Phloemyzus* is unusual in that only the sexuales are alate, all the parthenogenetic generations being apterous. He also noted that since oviparae can only distribute the members to any distance, the rate of spread of any virus in the autumn is likely to be small. The member of the only genus of the subfamily is reported to be autoecious and holocyclic on Poplars in Northern and Central Europe, while it leads anholocyclic life cycle on Poplar in Italy.

Further details are provided under the descriptions of genus and species.

Genus 1. *Phloemyzus* Horvath, 1896

1896. *Phloemyzus* Horvath, G., *Wien. ent. Ztg.*, **15** : 5 ; Smith, C.F. 1974, *Proc. ent. Soc. Wash.*, **76** (1) : 66 ; Type species : *Schizoneura passerinii* Signoret.
1886. *Loewia* Lichtenstein, J., *Monog. des Pucerons du peuplier*, Montpellier, 37. Type species : *Schizoneura passerinii* Signoret.

Morphology : Body of medium size. Head pale in viviparae. Antennae 5-6 segmented, darker than head, hardly 0.18—0.25 × as long as the body; processus terminalis 0.16 × as long as base of segment VI; hairs on flagellum minute, sparse, secondary rhinaria

absent in apterae. Eyes 3-faceted in apterae. Rostrum reaches middle of abdomen, ultimate rostral segment $1.7-2.0 \times$ as long as second segment of hind tarsus and bears 2 inconspicuous accessory hairs. Thorax pale. Abdominal dorsum in apterae pale; 7th tergite with large marginal wax plate. Siphunculi small, pore-like. Cauda semilunar or rounded with 8 hairs. Legs uniformly dark, first tarsal segments with 3 short hairs. Wing veins dark, often reduced, media once branched; wings kept flat in repose.

Both, sexual males and oviparae, are alate and have dark head, 6-segmented antennae without secondary rhinaria, 2-4 accessory hairs on ultimate rostral segment, fuscus wing veins with once or twice branched media, (which along with cubitus may be indistinct in males), large wax glands on 7th tergite (in ovipara), conspicuous siphunculi and cauda, the latter with 4 (in male) to 10 (in ovipara) hairs; forewings in alate male may be shorter or longer than the body.

Discussion: *Loewia* was erected by Lichtenstein (1886) to accommodate *S. passerinii* Signoret but as the name was preoccupied, Horvath (1896) proposed *Phloemyzus* with *S. passerinii* as type; since 1931, at least three species, two from Europe, viz. *redelei* H.R.L. 1931 and *dubius* Börner, 1931/2 and one from North America *dearborni* Smith, 1974 have been described under this genus. But detailed studies indicate that there exists only one species, widely distributed over the World and all three species mentioned are now regarded as synonyms of *passerinii* Signoret (Eastop & Hille Ris Lambers, 1976). The confusion apparently arose from morphological variants in different geographical areas and apparent assumption that all these species are host specific. In reality, *passerinii* has a wide host spectrum on *Populus*.

Biology: The species is autoecious on *Populus*, living in the crevices of stem, under bark, even on roots but never forming galls. Colonies may be large or may restrict itself to few trees (Smith, 1974) and have wooly secretion. Sexuales are known from North America and North Europe but in other areas only parthenogenetic forms are noted. Each oviparous female deposits only 2 eggs; males & females are winged with functional mouth (2 eggs & parts). Hill's (1926) description of male from Egypt is assumed

to be of abortive morph by Bodenheimer and Swirski (1957). In the region, *P. passerinii* has been noted from Pakistan on *Populus ciliata* which grows between 1400—3300 m at Murree, Poonch, Swat, Kishenganga & Kaghau Valley and has a pest complex of total of 7 species (including 6 Pemphiginae); the species is reported to occur all through the year but populations remain small and localised (Habib and Ghani, 1970). The host range includes *Populus alba*, *Populus canadensis*, *Populus ciliata*, *Populus nigra*, and *Populus tremuloides* in Middle East, Indian region and North America.

Distribution : Pakistan; Middle East; Africa; Central Asia; England, Europe; North America and South America.

Type species : *Schizoneura passerinii* Signoret, 1875. Location of type not known.

1. *Phloeomyzus passerinii* (Signoret) (Figs. 1-5)

1875. *Schizoneura passerinii* Signoret, V., *Ann. ent. Soc. France* (5) : 5 : cc II.

1896. *Phloeomyzus passerinii* Horvath *Wein ent. Ztg.*, **15** : 5.

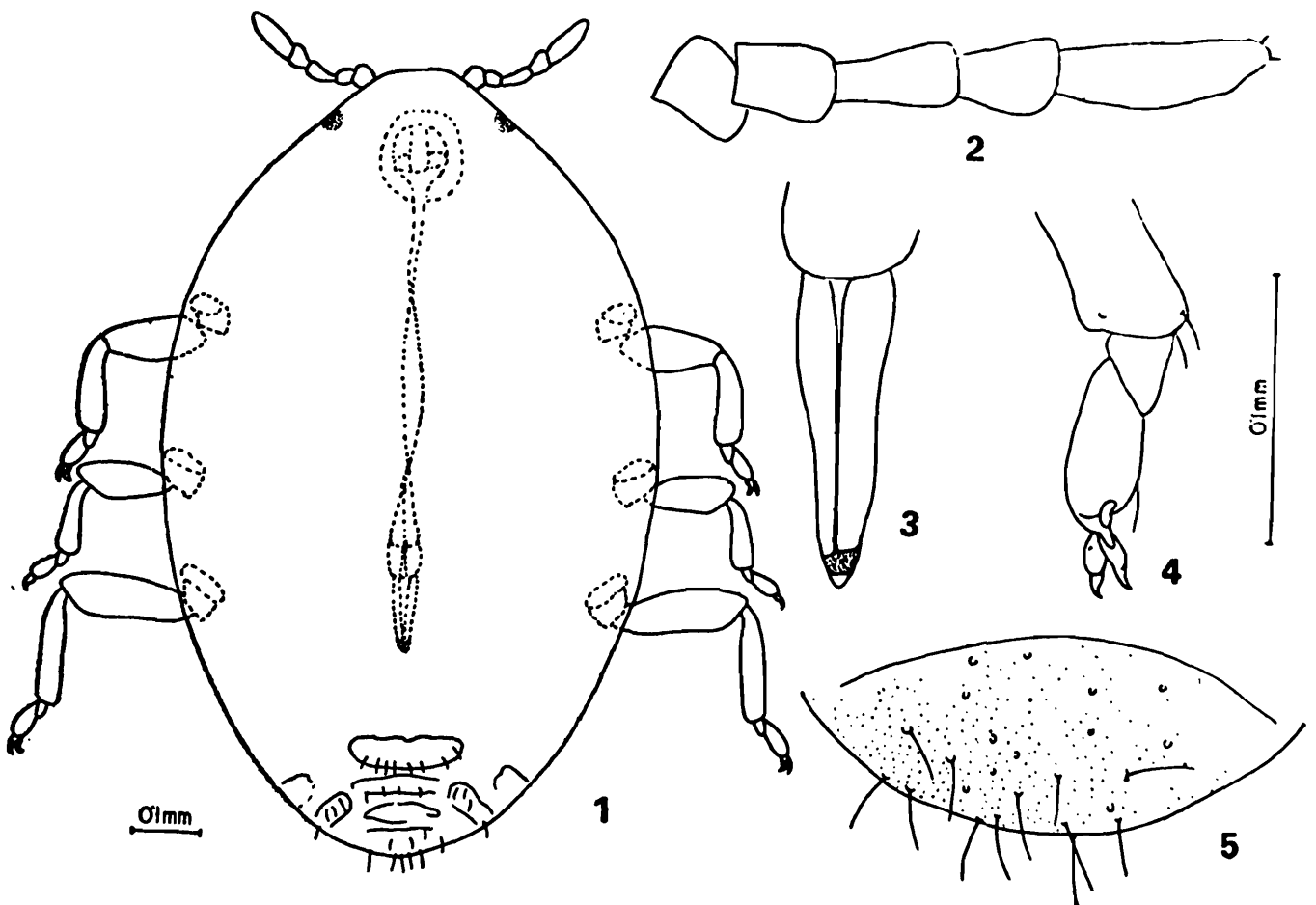
1931. *Pnloeomyzus redelei* Hille Ris Lambers, D., *Mem. Mus. Storia. Natur. Venezia Tridentina*, **1** : 29.

1931-32. *Phloeomyzus dubius* Börner, C. and Schilder, FA. *In* Sorauer's *Handbuch der Pflanz.*, **5** (2) : 551.

1974. *Phloeomyzus dearbornii* Smith, C.F., *Proc. ent. Soc. Wash.*, **76** (1) : 66.

Apterous viviparous female : (material not available from the region, description based on material from England). Body elongated, 1.51—1.65 mm long with 0.89—0.97 mm as maximum width, pale except head, antennae, rostrum, legs, sclerotic areas on 7th and 8th tergite and spiracular plates which are dusky-brown. Dorsal cephalic hairs sparse, minute. Antennae 5-segmented, $0.18\times$ as long as the body; segment I broader than long, segment II, III and IV subequal, segment V being the longest of all antennal segments; hairs on antennae very sparse not more than 1-2 on any segment; segment III feebly imbricated, rest smooth; process terminalis $0.16\times$ as long as base of last antennal segment;

primary rhinaria rounded. Eyes of 2-3 facets. Rostrum reaches at least hind coxae, ultimate rostral segment slender, $1.9-2.0\times$ as long as second segment of hind tarsus and bears a pair of short accessory hairs. Abdominal dorsum pale; dorsal hairs hardly discernible; 6th, 7th and 8th tergite, each with paired, marginal sclerotic wax plates, bearing 2 (on 6th and 7th) to 4 (on 8th) hairs, $0.016-0.023$ mm long. 8th tergite also with a pair of similar spinopleural plates bearing a total of 4 similar hairs. Subanal plate sclerotic, with 28-30 hairs. Subgenital plate of similar nature, bearing about 9-10 hairs on anterior half and about 16 hairs on posterior portion. Cauda semilunar with 4 hairs, upto 0.033 mm long. Legs short, dark, with trochanters fused with femora, bearing sparse, fine hairs upto 0.013 mm long; first tarsal segments with 3, 3, 3 hairs.



Phloemyzus passerini (Signoret). Apterous viviparous female : 1, whole body ; 2, antennae 3, ultimate rostral segment ; 4, hind tarsus, 5, Caudal region.

Colour: Greenish yellow or yellow with mealy cover.

Measurements in mm:

	Length	Width	Antenna	Antennal segments			urs	ht ₂
				III	IV	V		
1.	1.51	0.89	0.27	0.05	0.04	(0.08+0.013)	0.13	0.066
2.	1.65	0.97	0.27	0.05	0.04	(0.08+0.013)	0.14	0.07

(1, 2 ex *Populus* bark, Surrey, Richmond, 29.vi.1934, BMNH).

Other morphs: Not available; Smith (1974) has provided descriptions of alate ovipara and male under *dearborni*.

Material examined: Four apterous viviparous females from *Populus* bark, Surrey, Richmond, England, 29.vi.1934, Coll. J. Johnstone, det. F. Laing (BMNH Colls.).

Discussion: The species has already been discussed under the genus. It is likely that a proper search and correct identification may lead to its finding in Northwest Himalaya, specially in this area with *Populus ciliata*.

Distribution: Pakistan; wide spread in other parts of the World.

Types: Location of types not known.

Subfamily ANOECIINAE

Body pale to dark, 1.7—2.7 mm long, with or without marginal tubercles. Antennae usually 6-segmented, rarely 5-segmented in apterae, much shorter than the length of body; secondary rhinaria, may be present both in apterae and alatae, usually round or oval or semicircular and non-ciliated, almost always variably protruberant; processus terminalis distinctly shorter than base of last antennal segments. Eyes may be 3-faceted or normal in apterae. Rostrum 5-segmented, shorter or distinctly longer than second segment of hind tarsi and may bear 2—10 accessory hairs. Tergum pale or with sclerotic patch, abdominal tergites may be variably fused; marginal sclerotic patch (in *Anoecia*) usually with wax plates. Dorsal hairs fine, acute or increassate or fan-shaped at

apices. Siphunculi on pale to brown cone. Cauda broadly rounded. Anal plate entire. Subgenital plate may or may not be defined. First tarsal segments with 5—8 hairs. Empodial hairs fine. Forewings with media once or twice branched. Sexuales may be with wings (*Aiceona*), or without wings (*Anoecia*) and siphunculi may be absent in some males of some species (*Aiceona*).

The subfamily as considered here is composed of two tribes, Aiceonini and Anoeciini, each containing a single genus, *Aiceona* Takahashi and *Anoecia* Koch, respectively. The genus *Anoecia* Koch was considered under tribe Lachnini of subfamily Aphidinae by Baker (1920), while Takahashi (1931) put *Aiceona* and *Anoecia* in the subtribe Anoecina, tribe Anoecini under subfamily Lachninae, and Palmer (1952) apparently supported Takahashi (op. cit.). Bodenhasmer and Swirski (1957) considered *Anoecia* under separate subfamily Anoeciinae but included the same under family Thelaxidae and Zwölfer (1957) followed the same system of classification. Eastop and van Emden (1972) treated Anoeciinae as a subfamily under Aphididae and recognised two tribes, Anoeciini and Aiceonini. Raychaudhuri, Pal and A. K. Ghosh (1980) discussed in detail the justification of inclusion of this group under Aphididae, as a distinct family, rather than putting under Hormaphidinae (=Thelaxinae).

The subfamily contains about 40 species of aphids. The members of the genus *Anoecia* which are holarctic in distribution, show in typical life-cycle, alternation between *Cornus* and roots of Graminae or may lead a holocyclic life-cycle on Graminae. The return migration in case of *Anoecia* is accomplished by sexuparae which may deposit apterous sexuales and fundatrices appear similar to sexuales on roots of gramineae, suggesting a possible recent acquisition of primary host (Eastop 1977). Members of the genus *Aiceona*, are mostly restricted to Southeast Asia and indicate Lauraceae as the preferred host plant family.

The ability to transmit virus to plant is known to be rather poor in the members of the subfamily. The natural enemies also appear to be fewer for this group of aphids.

Taxonomic works concerning the regional fauna of Anoeciinae include: Bodenheimer & Swirski (1957): Middle East; Börner

(1952): Central Europe Heie (1981): Scandinavia; Palmer (1952): U.S.A.; Raychaudhuri, Pal, A. K. Ghosh (1980): India; Shaposhnikov (1964): U.S.S.R; Takahashi (1931) : Formosa (1966), Japan; Zwölfer (1957): Central Europe.

Extensive biological studies on the group have been published by Mordvilko (1931 a.b.c.) and Zwölfer (1957).

Key to the Tribes

Apterae with eyes 3-facetted and abdominal dorsum pale. Lateral abdominal tubercles absent. Mesothoracic furca with separate arms. Subgenital plate indistinct. Alatae with media of forewings twice branched. Usually on Lauraceae.....AICEONINI

Apterae with eyes many faceted and abdominal dorsum usually sclerotised. Lateral abdominal tubercles present. Mesothoracic furca with arms united at base. Subgenital plate entire. Alate with media of forewings once branched. Usually on *Cornus* and Graminae.....ANOECIINI

The tribe Aiceonini is represented by only one genus *Aiceona* Takahashi and the tribe Anoeciini is represented by the genus *Anoecia* Koch, and as such no separate account of the tribe is provided.

Genus 2. *Aiceona* Takahashi, 1921

1921. *Aiceona* Takahashi, R., *Spec. Rep. Formosa agric. Exp. Stn.*, **20** : 85 ; Takahashi, R. 1980. *Ins. matsum.*, **23** (1) : 1 ; Raychaudhuri, D. N., Pal. P. K., Ghosh, A. K. 1980. Aphids of North East India and Bhutan, 40. Type-species : *Aiceona actinodaphnis* Takahashi.

Morphology: Body 2.2—3.3 mm. long, pale to pale brown. Antennae usually 6-segmented, rarely 5-segmented, $0.34—0.66 \times$ as long as the body, with fine spinular imbrication on flagellum; processus terminalis $0.25—0.75 \times$ as long as base of last antennal segment; primary and secondary rhinaria round to oval, protuberant, non-ciliated; secondary rhinaria present on segment III, IV and V of alatae, usually numerous on segment III; hairs on flagellum numerous, fine. Eyes of 3 facets in apterae, normal but

with small ocular tubercles in alatae. Rostrum hardly exceeding hind coxae, ultimate rostral segment stilleto-shaped, $0.56-1.40\times$ as long as second segment of hind tarsus, with 2-8 accessory hairs. Mesothoracic furca with separated arms. Abdominal dorsum pale; alatae sometimes with dorsal segmental sclerotic bands; dorsal hairs numerous, fine, marginal hairs usually in clusture; 7th and 8th tergites each with 12—16 hairs. Siphunculi on hair-bearing cone. Cauda broad, rounded with many fine hairs. Subanal plate entire. Subgenital plate not defined.

Legs pale, trochanters indistinctly fused with femora, dorso-apical hairs on second tarsal segments short, never exceeding length of claws, with acute apices; empodial hairs shorter than claws; first tarsal segments with 5-8 hairs. Wings pale to fuscous, forewings with pterostigma short, subcosta and pterostigma with 1-2 rows of hairs; media twice branched; hind wings with both obliques.

Sexuales alate. Oviparous female without pseudosensoria on hind tibiae. Alate males may be without sclerites in abdomen, but with longer antennae, fewer secondary rhinaria on III antennal segment, while 0-1 on other segments and with or without siphunculi (e.g. *japonica*). Claspers with numerous hairs.

Discussion: This is a typically eastern Asiatic genus with 15 valid species distributed over Japan, Okinawa, Formosa, Thailand, Malayasia and India and Nepal. Singh and Raychaudhuri (1975) described an allied genus *Subaiceona* and *S. manipurens*, a new species collected on *Machilus*, on the basis of presence of a stout spine-like hair on 8th sternite, reticulation near base of III antennal segment and nearly straight radial sector; this is treated here as a subgenus. Out of a total of 15 species, 7 species have only been recorded from India and 2 from Nepal as endemic. The genus is closely related to *Anoecia* Koch, but differs from the former in the absence of marginal tubercles, absence of dorsal sclerotization and in separated arms of mesothoracic furca in aptera and nature of secondary rhinaria, wing venation and absence of sclerites in alatae. The genus can be regarded as a homogeneous group almost exclusively feeding on trees of Lauraceae in its entire

area of distribution. Takahashi (1960) and M.R. Ghosh and Raychaudhuri (1973), Raychaudhuri, Pal, A. K. Ghosh (1980) have dealt with the genus in recent years.

Biology: All the species of the genus are known to infest trees of Lauraceae except *A. himalica* which infest Juglandaceae in Nepal (Miyazaki, 1977); at least six species, *A. himalica* Miyazaki, *A. japonica* Takahashi, *A. titabarensis* (Raychaudhuri & A. K. Ghosh), *A. paraosugii* A. K. Ghosh, M. R. Ghosh, Raychaudhuri, *A. retipennes* David, Narayanan, Rajasingh and *A. robustisete* M. R. Ghosh and Raychaudhuri, are also known by sexual forms on the same host plants on which viviparae appear. As such, the members of this genus can be considered to have evolved through a monoecious, holocyclic, life-cycle on Lauraceae. All the species have been recorded during the months of December—June, in the temperate region of the areas of distribution. Myrmecophily is known at least in five of the seven endemic species. Most of the species form colonies on tender shoots and undersurface of leaves and infested leaves may sometimes roll along the length; some species secrete profuse honey dew (e.g. *pallida*) and many have white powdery secretions over the body. Natural enemies for this group of aphids are little known.

Distribution: India; Nepal; Malayasia; Thailand; Formosa; Okinawa; Japan.

Type species: *Aiceona actinodaphnis* Takahashi 1921; deposited in the Agricultural Research Institute, Taipei, Formosa.

Subaiceona manipurens Singh and Raychaudhuri 1975, is treated as the type of subgenus *Subaiceona*; deposited in the collection of Entomology Laboratory, Department of Zoology, University of Calcutta, Calcutta, India.

Key to the subgenera of *Aiceona*

- 1(2) 8th sternite with a short stout spine-like hair.
 Ultimate rostral segment broad. Alatae with
 reticulated pattern of imbrication near base of
 antennal segment III ; fore-wings with radial
 sector nearly straight.....*Subaiceona* Singh and
 Raychaudhuri

- 2(1). 8th tergite without any spine-like hair.
 Ultimate rostral segment stilleto-shaped.
 Alatae without any reticulated pattern wore
 base of segment III ; fore-wings with radial
 sector curved.....*Aiceona* Takahashi

List of species of *Aiceona* S. l. Takahashi, from the World

<i>actinodaphni</i>	Takahashi, 1921	—	Formosa, Okinawa
<i>himalaica</i>	Miyazaki, 1977	—	Nepal
<i>japonica</i>	Takahashi, 1960	—	Japan
<i>malayana</i>	Takahashi, 1960	—	Malaysia
<i>manipurensis</i> (<i>Subaiceona</i>)	Singh & Raychaudhuri, 1975	—	India
<i>osugii</i>	Takahashi, 1924	—	Formosa
<i>pallida</i>	A. K. Ghosh & Raychaudhuri, 1973	—	India
<i>paraosugii</i>	A. K. Ghosh et al., 1971	—	India
<i>parvicornis</i>	Miyazaki, 1977	—	Nepal
<i>pseudosugii</i>	David et al., 1970	—	India
<i>retipennis</i>	David et al., 1970	—	India
<i>robustiseta</i>	M. R. Ghosh & Raychaudhuri, 1973	—	India
<i>siamensis</i>	Takahashi, 1941	—	Thailand
<i>tanakai</i>	Takahashi, 1963	—	Japan
<i>titabarensis</i>	Raychaudhuri & A. K. Ghosh, 1964	—	India

Key to the species of *Aiceona*

Apterous viviparous females:

1. Hairs arising from distinct sclerites or dusky
 sclerotic base. Ultimate rostral segment nearly
 equal or little longer than second segment of
 hind tarsus and bears 6-8 accessory hairs..... 2

Hairs never arising from distinct sclerites or
 sclerotic bases. Ultimate rostral segment 0.54—
 1.4 × as long as second segment of hind tarsus
 and bears 2-8 hairs..... 3

2. Dorsal hairs stout, arising from distinct, scattered sclerites. Siphunculi on dark or brown sclerotic cones. Abdominal dorsum brownish often with small pleural patches 8th tergite with 8-12 hairs. Cauda with 12-14 hairs.....*A. titabarensis* (Raychaudhuri & A. K. Ghosh)

Dorsal hairs fine arising from dusky sclerotic bases. Siphunculi on pale cones or little dusky. Abdominal dorsum pale. 8th tergite with 6 hairs. Cauda with 8-9 hairs. Creamy yellow to to dirty grey in life.....*A. pallida* (Ghosh & Raychaudhuri)

3. Hairs on vertex upto 4.6—6.4 x, on flagellum 4.0—5.0 x and on abdominal dorsum 5.0—7.0 x as long as basal diameter of antennal segment III. Ultimate rostral segment with 2 accessory hairs. 8th tergite with 12 hairs. First tarsal segments with 5, 5, 5 or 5, 5, 6 hairs.....*A. longisetosa* Ghosh & Raychaudhuri)

Hairs variable, if long and fine on abdomen then ultimate rostral segment with more than 2 accessory hairs and 8th tergite with not more than 8 hairs.....4

4. Antennal segment VI with one accessory rhinaira placed wide apart from primary rhinariam. Dorsal plae, hairs fine. Ultimate rostral segment 0.70—0.80 x as long as second segment of hind tarsus and bears 4-8 accessory hairs. Siphunculi with large pori.....5

Antennal segment VI with accessory rhinaria placed close to primary rhinarium. Dorsal hairs of variable length and apices ; dorsum pale or with aerolations. Ultimate rostral segment 0.54—1.4 x as long as second segment of hind tarsus and with 2-8 hairs.....6

5. Dorsal cephalic hairs upto 0.130—0.146 mm long and 3.8 x as long as basal diameter of antennal segment III. Dorsal hairs on anterior tergites upto 0.130 mm long, on 8th tergite 0.156 mm long. Cauda with 17-19.....*A. himalica* Miyazak

Dorsal cephalic hairs upto 0.160 mm long, $3.1 \times$ as long as the basal diameter of antennal segment III. Dorsal hairs on anterior tergites upto 0.180 mm long, on 8th tergite upto 0.200 mm long. Cauda with 10 hairs.....*A. pseudosugii* David,
Sekhon, Bindra

6. 8th tergite with 7-8 hairs, upto $5.6-6.5 \times$ as long as basal diameter of antennal segment III. First tarsal segment usually with 5-6 hairs, or with an additional sense peg-like structure.....7

8th tergite with 6-23 hairs, upto $3.5 \times$ as long as second segment of hind tarsus. First tarsal segment with 6-9 hairs. Dorsum may be pale or with aerolations.....8

7. Ultimate rostral segment $1.3-1.4 \times$ as long as second segment of hind tarsus and bears 8 accessory hairs. Dorsal hairs fine, 0.150 mm long, $5.0-5.5 \times$ as long as of basal diameter of antennal segment III. First tarsal segment with 6, 6, 6 hairs besides a sense peg.....*A. paraosuguii* Ghosh,
Ghosh & Raychaudhuri

Ultimate rostral segment $0.85-0.92 \times$ as long as second segment of hind tarsus and bears 3-5 accessory hairs. Dorsal hairs 0.140-0.210 mm long, $3.2-4.8 \times$ as long as basal diameter of antennal segment III. Cauda with 10 hairs. First tarsal segments with 5-6 hairs.....*A. robustiseta* Ghosh &
Raychaudhuri

8. Dorsum with intersegmental aerolations bearing small sclerites on 6th-8th tergites, at bases of hair. 8th tergite with 21-23 hairs. Ultimate rostral segment with 2-3 accessory hairs. Longest hair on hind tibia upto $2.0 \times$ as long as the diameter at the middle of the tibia.....*A. parvicornis* Miyazaki

Dorsum pale membranous, without scleroties as above. 8th tergite with 6 hairs. Ultimate rostral segment with 4 accessory hairs. Longest hair on hind tibia upto $3.2 \times$ as long as the diameter at the middle of the tibia.....*A. retipennis* David,
Narayanan, Rajasingh

Alate viviparous females :

1. Forewings with numerous long hairs scattered all over the surface. Wings smoky. Ultimate rostral segment about $1.25-1.50\times$ as long as second segment of hind tarsus. Antennal segment III with 20-27, IV with 7-14 and V with 1-8 secondary rhinaria. 8th tergite with 7-12 hairs.....*A. titabarensis* (Raychaudhuri & A. K. Ghosh)

Forewings with hairs arranged only along subcosta and pterostigma. Wings pale or smoky. Ultimate rostral segment shorter than or at most upto $1.25\times$ as long as second segment of hind tarsus. Secondary rhinaria on flagellum more numerous, if fewer, then ultimate rostral segment at most $0.62\times$ as long as second segment of hind tarsus.....2

2. Wings with polygonal cell at least near the apex appearing as dark reticulation. Ultimate rostral segment $0.60-0.66\times$ as long as second segment of hind tarsus, bearing 6 accessory hairs. Antennal segment III with 27-37 secondary rhinaria with protruding membrane, IV with 91-3 and V with 3-6 secondary rhinaria.....*A. retipennis* David. Narayana, Rajasingh

Wings never reticulated.....3

3. Ultimate rostral segment equal or longer than second segment of hind tarsus.....4
Ultimate rostral segment distinctly shorter than second segment of hind tarsus.....5

4. Dorsal hair on abdomen $6.6-8.3\times$ as long as basal diameter of antennal segment III. Antennal segment III with 43-45, IV with 12-15, V with 6-7 and base of VI with one secondary rhinaria.....*A. paraosugii* Ghosh, Ghosh, & Raychaudhuri

Dorsal hair on abdomen $3.5-5.6\times$ as long as the basal diameter of antennal segment III. Antennal segment III with 50-66, IV with 16-25, V with 6-14 secondary rhinaria.....*A. pallida* Ghosh & Raychaudhuri

5. Antennal segment III with 71-74, IV with 23-24 and V with 10-13 rather large protuberant secondary rhinaria. 8th tergite with 18 hairs. Cauda with 6 hairs.....*A. parvicornis* Miyazaki

Antennal segment III with less than 50, IV with less than 20 and V with less than 10 secondary rhinaria. 8th tergite with 5-10 hairs.....6

6. Body 2.7—3.3 mm .long. Antennae 0.6—0.7 × as long as the body, bearing 43—43 secondary rhinaria on segment III, 13-18 on segment IV and 3-5 on segment V. Abdominal dorsum with sclerotic spinal bars on 1st—3rd tergites*A. pseudosugii* David,
Sekhon, Bindra

Body 2.2—2.4 mm long. Antennae 0.52—0.58 × as long as the body, bearing 32-38 secondary rhinaria on segment III, -8-11 on segment IV and 2-7 on segment V. Abdominal dorsum with segmental sclerotic bands on 1st-7th tergites. Siphunculi on broad cone.....*A. robustiseta* Ghosh &
Raychaudhuri

Alate oviparae :

1. Hairs on forewings scattered all over ; u.r.s. about 1.14—1.25 × h.t. 2 ; dorsal cephalic hairs about 3.65—3.75 × b.d. III ; segment III, IV, V and base of segment VI with 17-26, 8-12, 2-6 and 1 secondary rhinaria respectively.....*A. titabarensis*
(Raychaudhuri
& A. K. Ghosh)

Hairs on forewings arranged only along subcosta and pterostigma. Secondary rhinaria more numerous.....2

2. Processus terminalis about 0.94 × base of last antennal segment ; u.r.s. about 1.40 × h.t. 2. siphuncular cone with 7-10 hairs. Longest dorsal cephalic hair about 0.16 × basal diameter of antennal segment III.....*paraosugii* Ghosh,
Ghosh & Raychaudhuri

Processus terminalis about 0.41—0.47 × base of last antennal segment. Ultimate rostral segment 0.82—1.04 × as long as hind tarsus 3

3. Ultimate rostral segment distinctly shorter than second segment of hind tarsus bearing 6 long accessory hairs. Siphunculi surrounded by 15-20 hairs.....*A. himalica* Miyazaki

Ultimate rostral segment $1.0-1.2\times$ as long as second segment of hind tarsus. Siphunculi surrounded by 27-30 hairs.....*A. robustiseta* Ghosh & Raychaudhuri

2. *Aiceona himalaica* Miyazaki (Figs. 6-12)

1977. *Aiceona himalaica* Miyazaki, Masahisa, *Kontyu*, 45 (2) ; 207.

Apterous viviparous female: Body 2.4—2.8 mm long. Head smooth; dorsal cephalic hairs fine, 20—26 in number, 0.130—0.146 mm long, upto $3.6-3.8\times$ as long as basal diameter of antennal segment III. Antennae 6-segmented, pale, distally dusky from segment IV apicad, $0.61-0.68\times$ as long as the body; flagellum feebly imbricated; hairs on the flagellum fine; upto 0.100 mm long, longest one on segment III $2.5\times$ as long as the basal diameter of the segment; processus terminalis $0.41-0.50\times$ as long as base of antennal segment VI. Rostrum just reaches hind coxae, ultimate rostral segment $0.73-0.80\times$ as long as second segment of hind tarsus, with 4-6 hairs. Abdominal dorsum pale, membranous; hairs on the dorsum of abdomen fine, flagellate, 0.06—0.130 mm long, $3.3\times$ as long as the basal diameter of the segment; 8th tergite with 10—13 hairs, upto 0.146 mm long, $3.8\times$ as long as the mentioned diameter. Siphunculi on pale cones, with large pores, surrounded by 35—40 hairs. Cauda with 17—19 hairs. Legs smooth, long, pale brown with hind tibiae distinctly darker; hairs on femora and tibiae fine, those on hind tibiae upto $2.9-3.4\times$ as long as the width at the middle of the tibia; first tarsal segments with 8, 8, 9 hairs or with 10, 10, 9 hairs; second tarsal segments with long ventral hairs.

Colour: Not recorded.

Measurements in mm:

	Length	Width	Antenna	Antennal segments				urs	ht ₂
				III	IV	V	VI		
1.	2.50	1.16	1.60	0.63	0.28	0.30	(0.16+ 0.07)	0.18	0.23
2.	2.48	1.15	1.65	0.61	0.30	0.31	(0.16+ 0.07)	0.17	0.23

(1, 2 ex *Engelhardtia spicata*, Kathmandu, Nepal, 3.vii. 1968, Hokk. Univ. Colls.)

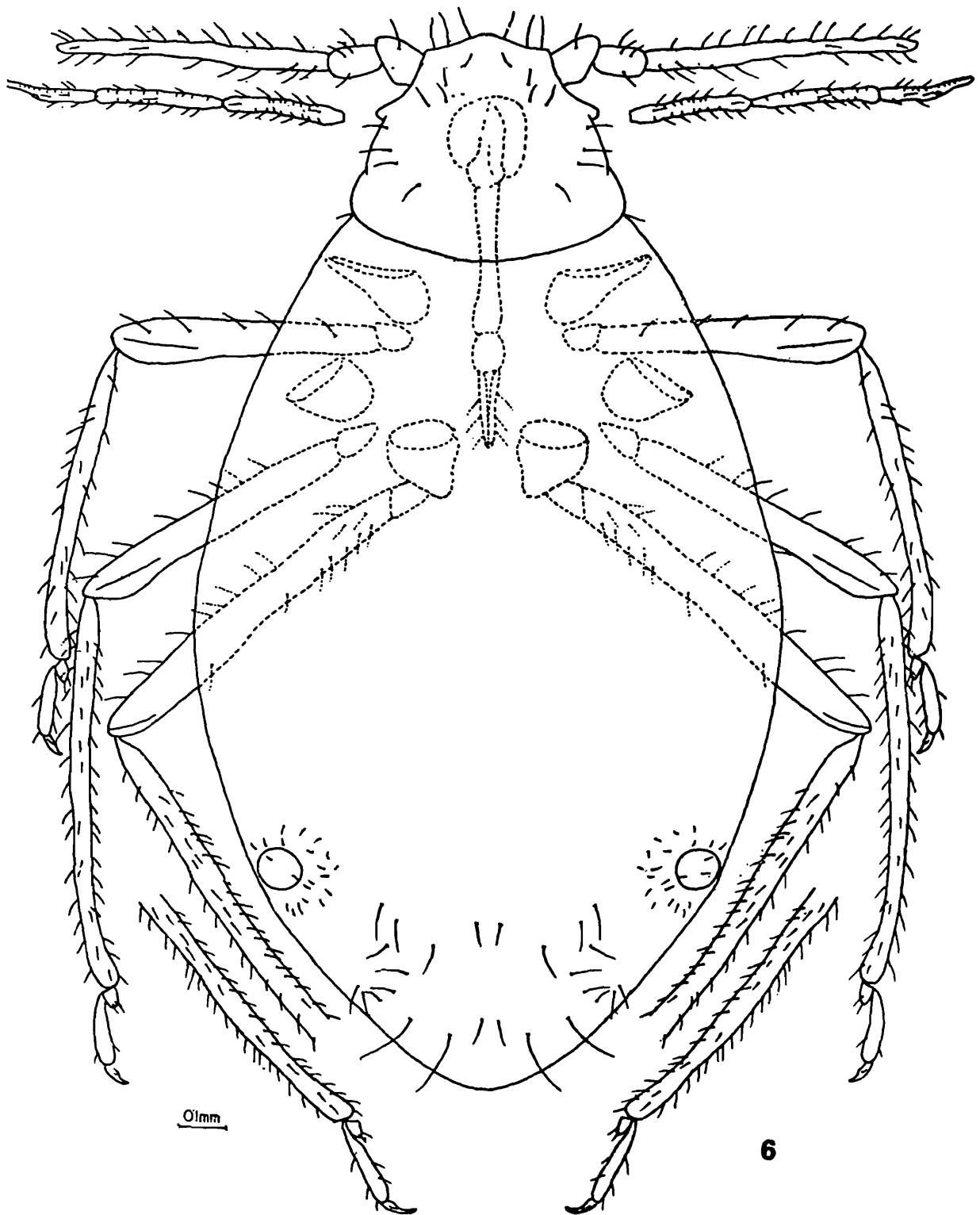
Alate oviparous female : Body 2.5 mm long. Head smooth. Antennae 6-segmented, $0.60\times$ as long as to body; antennal segment III with 41-48, IV with 12-18, V with 6-8, round to oval, protuberant secondary rhinaria, processus terminalis $0.40-0.47\times$ as long as base of segment VI. Rostrum reaches hind coxae, ultimate rostral segment $0.82-0.88\times$ as long as second segment of hind tarsus, with 6 long hairs. Abdominal dorsum pale, bearing spino-pleural sclerotic bands, which are narrow on 1st and 2nd tergites, broadest on 3rd tergite; hairs on the dorsum of abdomen fine, 8-10 per segment in spino-pleural region upto 0.100-0.130 mm long, $3.8-5.0\times$ as long as basal diameter of antennal segment III; 8th tergite with 8 hairs. Siphunculi with 15-20 hairs. Cauda with 17-18 hairs. Subanal plate with a pair of anteriorly directed horn-like projections. Subgenital plate with many flagellate hairs, posterior portion more sclerotic than anterior one with many fine hairs besides 5 short peg-like setae with acute apices, legs normal without any psedosensoria on hind tibiae.

Colours: Not recorded.

Measurements in mm:

Length	Width	Antenna	Antennal segments				urs	ht ₂
			III	IV	V	VI		
2.50	0.89	1.5	0.56	0.77	0.31	(0.15+ 0.07)	0.17	0.20

(ex *Engelhardtia spicata*, Balaju, Nepal, 3. vii. 1968, Hokk. Univ. Colls.)



Aiceona himalica Miyazaki. Apterous viviparous female : 6, whole body.

Alate male: Body elongate, slender and pale. Head large. Antennae 6-segmented, $0.82\times$ as long as the body; segment III with

38-40, IV with 11-12 and V with 5-7 secondary rhinaria. Abdominal dorsum without sclerotic bands on anterior tergites; spino-pleural hairs 5-7 per segment. Siphunculus absent. Hind legs much longer than the other legs. Otherwise similar to alate oviporous female except in sexual characters.

Measurements in mm:

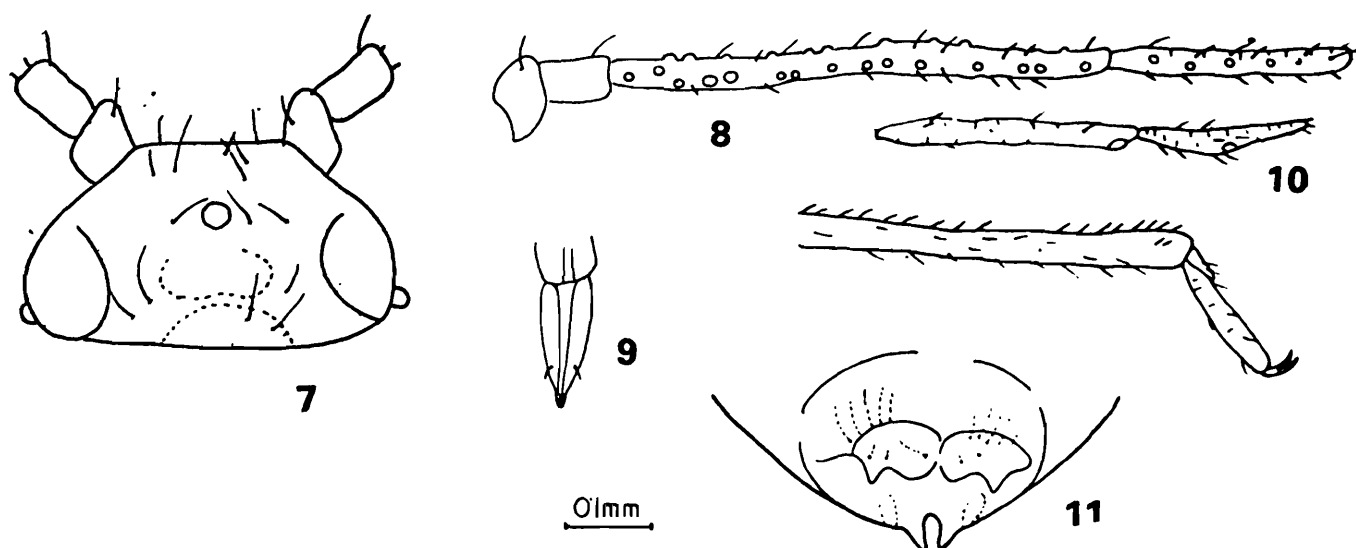
Length	Width	Antenna	Antennal segments				urs	ht ₂
			III	IV	V	VI		
2.10	0.65	1.72	0.65	0.34	0.30	(0.21+ 0.08)	0.15	0.19

Other morphs: Not available.

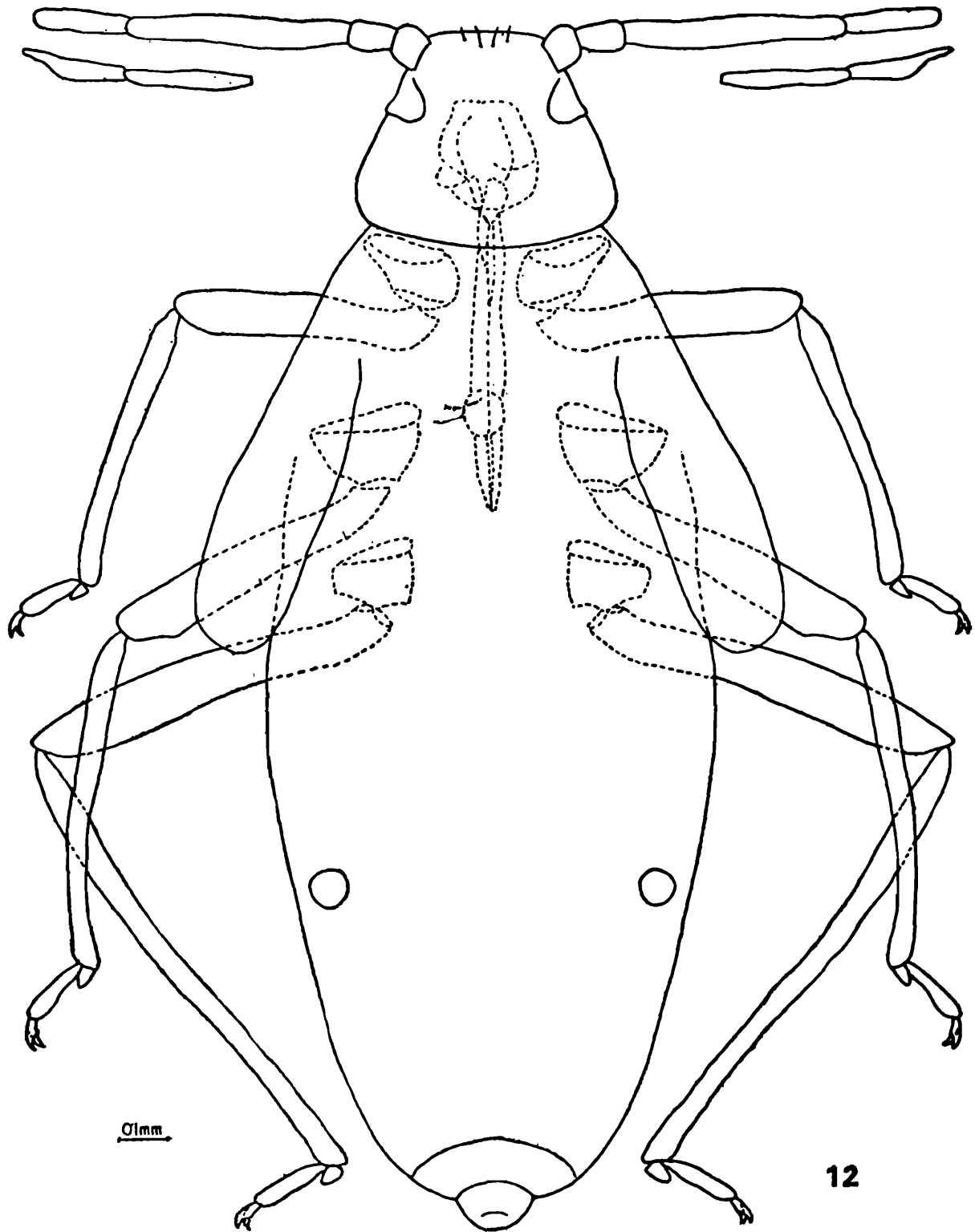
Material examined: Five apterous viviparous female, one oviparous female and one alate male from *Engelhardtia spicata*, Balaju, Nepal, 3.vii.1968; Coll. T. Kumata (Syntypes).

Discussion: The species comes close to *pseudosugii* David *et al.*, differing from the latter in having much large siphuncular pore and more caudal hairs besides being associated with a different host plant, *Engelhardtia spicata* (Juglandaceae); The species seems to be holocyclic and monoecious in the same host.

Distribution: Nepal.



Alate male : 7, head ; 8 antenna, 9. ultimate rostral segment ; 10, part of hind leg ; 11, male genitalia.



Alate nymph, 12 : whole body.

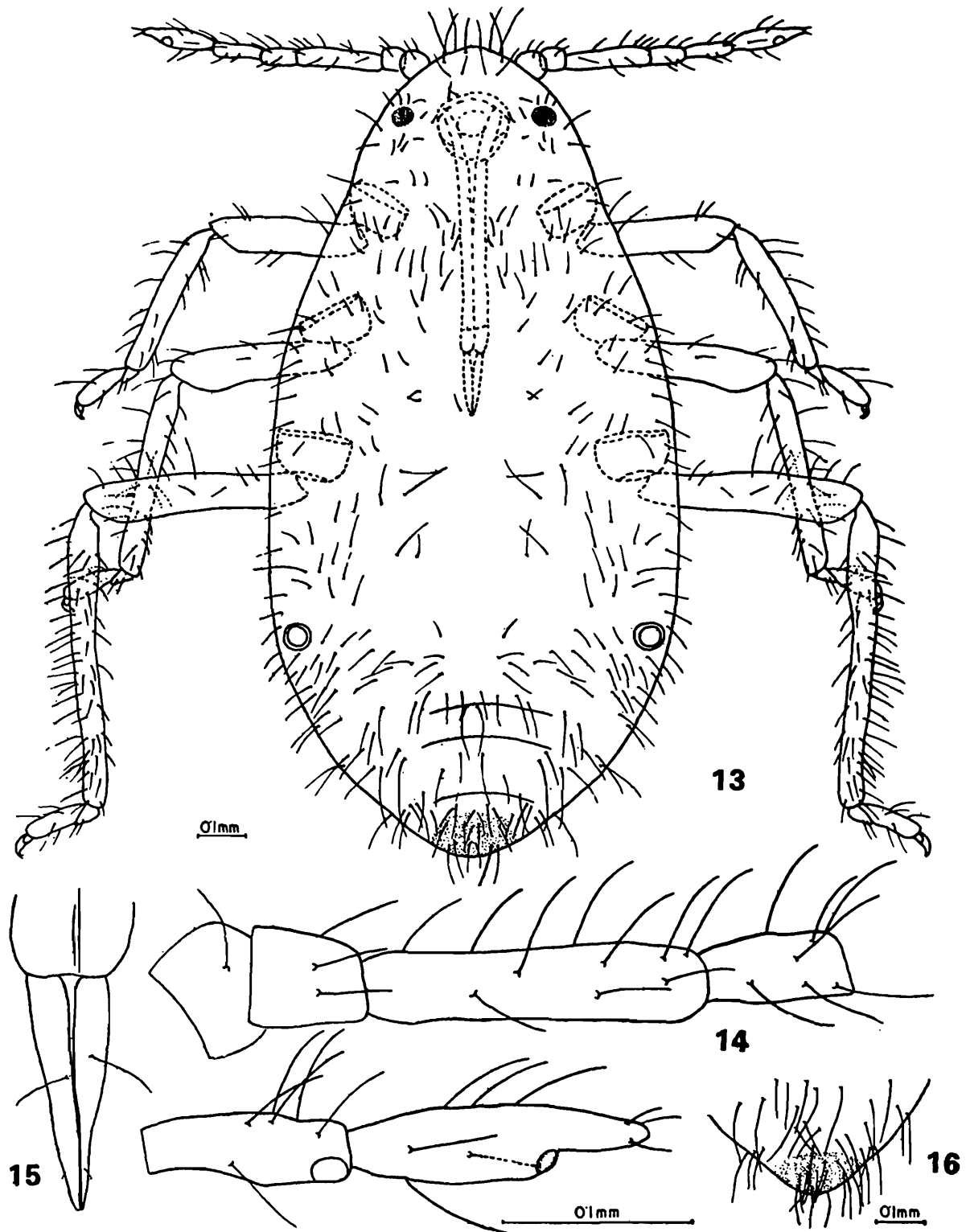
Types : Deposited in the Entomological Institute, Hokkaido University, Sapporo, Japan.

3. *Aiceona longisetosa* Ghosh and Raychaudhuri
(Figs. 13-16)

1973. *Aiceona longisetosa* Ghosh, M. R., and Raychaudhuri, D. N., *Orient. Insects*, 7 (4) : 550.
1976. *Aiceona longisetosa*, Eastop, V. F. and Hille Ris Lambers, D., Survey of the World Aphids, 19 (as synonym of *pseudosugii*).
1980. *Aiceona longisetosa*, Raychaudhuri, D. N., Pal, P. K., Ghosh, A.K. In : Aphids of North East India and Bhutan, 42.

Apterous viviparous female : Body 1.9—2.2 mm long with 0.90—1.13 mm as maximum width. Head not clearly separable from pronotum, pale brown to brown; dorsal cephalic hairs fine, 0.14—0.16 mm long, upto $4.6\text{--}6.4\times$ as long as the basal diameter of antennal segment III. Antennae 6-segmented, pale brown to brown, basal segments darker, $0.32\text{--}0.38\times$ as long as the body; flagellum gradually more distinctly imbricated from distal half of segment III apicad; hairs on the flagellum fine, 0.13—0.15 mm long, and longest one III, upto $4.0\text{--}5.0\times$ as long as the basal diameter of the segment; base of segment VI with 5-6 long fine hairs; accessory rhinaria on VI placed close to primary one; processus terminalis, $0.27\text{--}0.35+(0.45\times)$ as long as base of antennal segment VI. Rostrum reaches hind coxae, ultimate rostral segment slender, $0.78\text{--}0.88\times$ as long as second segment of hind tarsus and bears 2 accessory hairs which are 0.086—0.096 mm long. Abdominal dorsum pale, smooth, hairs on the dorsum of abdomen fine, upto 0.15—0.16 mm long, $5.0\text{--}7.0\times$ as long as the basal diameter of antennal segment III; 8th tergite with 12 hairs upto $5.0\text{--}5.5\times$ time long, as long as the mentioned diameter. Siphunculi on shallow cones surrounded by many long, fine hairs. Cauda with 7-8 hairs. Legs smooth pubescent, femora pale at base, rest variably pale to dark, brown; first tarsal segments with 5, 5, 5, or 5, 5, 6 hairs.

Colour : Pale yellow in life.



Aiceona longisetosa Ghosh & Raychaudhuri ; Apterous viviparous female :
 13, whole body ; 14, antenna ; 15, ultimate rostral segment ; 16, caudal
 region.

Measurement in mm:

	Length	Width	Antenna	Antennal segment				urs	ht ₂
				III	IV	V	VI		
1.	2.1	0.99	0.69	0.20	0.10	0.11	(0.11+ 0.03)	0.14	0.18
2.	1.9	0.90	0.67	0.13	0.10	0.10	(0.11+ 0.03)	0.13	0.17

(ex 1, 2, ex. unidentified plant, Kalimpong, W.B., 2.ii.1970, C.U).

Alate viviparous female: Not known.

Sexual forms: Not known.

Material examined: Three apterous viviparous females from unidentified plant, Kalimpong, West Bengal, India, 2.ii.1970, (Holotype and Paratype, C.U. Colls.).

Discussion: The pale yellow insects are reported to form small colonies on undersurface of leaves of host plants during February—April, in the hills of Kalimpong in West Bengal. Ants have been recorded in association.

This species was considered as a synonym of *pseudosugii* David *et al.* by Eastop and Hille Ris Lambers (1976) but examination of both the material and original description clearly indicates the distinct identity of this species (see discussion under *pseudosugii*) The species appears to be rare in occurrence.

Distribution: INDIA: West Bengal.

Types: In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India.

4. *Aiceona* (*Subaiceona*) *manipurensis* Singh and Raychaudhuri (Figs. 17—28)

1975. *Subaiceona manipurensis* Singh, T. K., and Raychaudhuri, D.N., *Proc. zool. Soc. Calcutta*, 28 : 156.

Apterous viviparous female: Body 2.0—2.90 mm long with 1.25—1.55 mm as maximum width. Head nearly fused with prothorax;

dorsal cephalic hairs 0.130—0.178 mm long, acute, upto $2.5\text{--}3.8\times$ as long as the basal diameter of antennal segment III. Antennae pale, 6-segmented, $0.5\text{--}0.7\times$ as long as the body; segment I shorter than wide; flagellum gradually more distinctly imbricated from apical half of segment III, apicad; hairs on flagellum fine, longest one on segment III, 0.86—0.155 mm long, $1.7\text{--}3.1\times$ as long as the basal diameter of the segment; secondary rhinaria absent; processus terminalis $0.40\text{--}0.60\times$ as long as base of segment VI. Rostrum reaches hind coxae, ultimate rostral segment somewhat convex on side, $0.68\text{--}0.90\times$ as long as second segment of hind tarsus and bears 4-6 accessory hairs. Abdominal dorsum pale, hairs on the dorsum of abdomen 0.086—0.130 mm long fine, acute, on anterior tergites upto $1.7\text{--}2.5\times$ as long as the basal diameter of antennal segment III; 8th tergite with 8-12 hairs of similar nature, 0.155—0.238 mm long, upto $3.1\text{--}4.5\times$ as long as the mentioned diameter, 8th sternite usually with one short stout spine-like hair in between fine hairs. Siphunculi on brownish, hairy cones. Cauda semioval bearing 8-10 hairs. Subanal plate rounded. Legs smooth, pale, hind tibiae little dark, bearing many long, fine hair; first tarsal segments with 7-8 long fine hairs except, one which is short and spiny; second tarsal segments faintly imbricated; empodial hair shorter than claws.

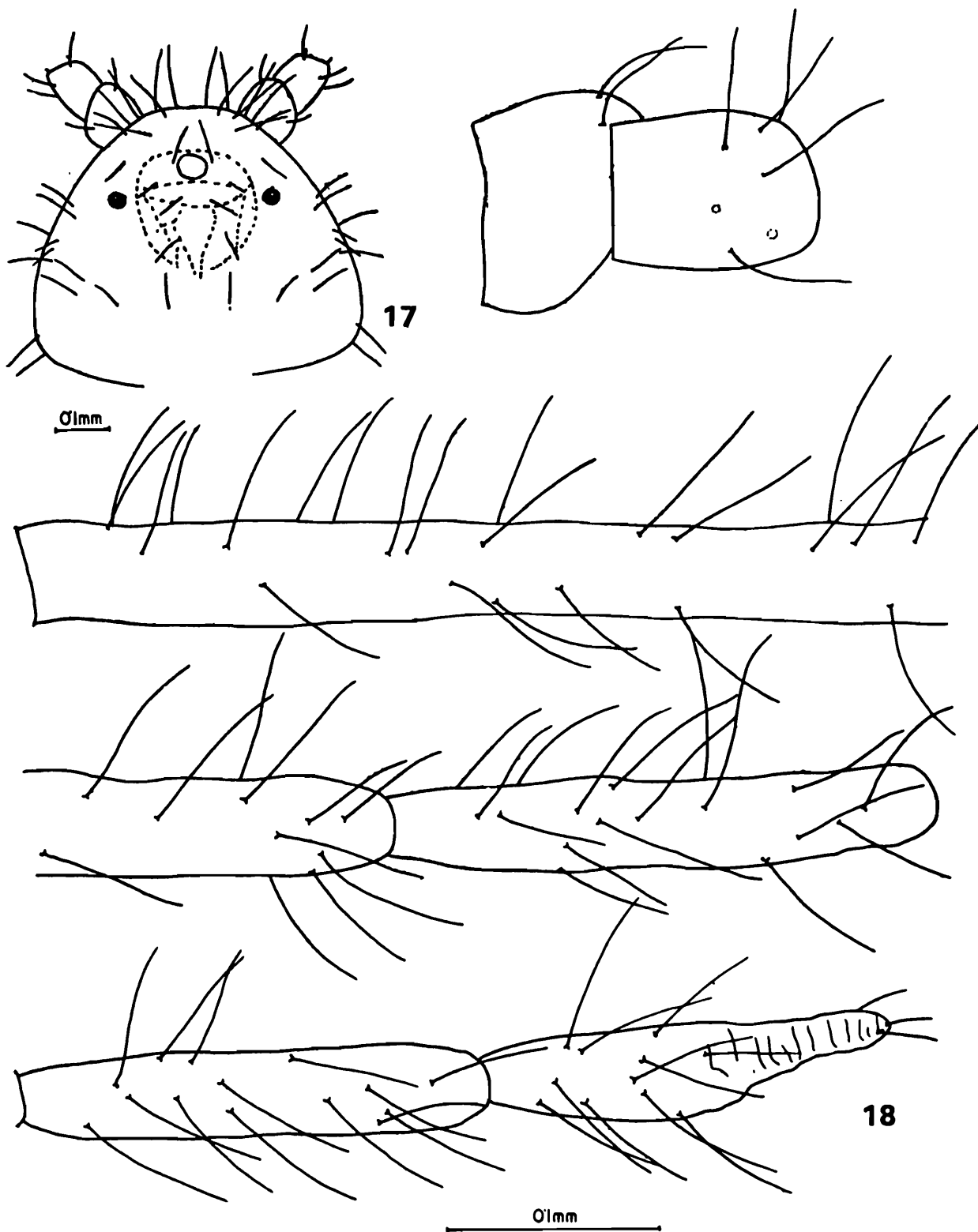
Colour: Yellowish in life.

Measurements in mm:

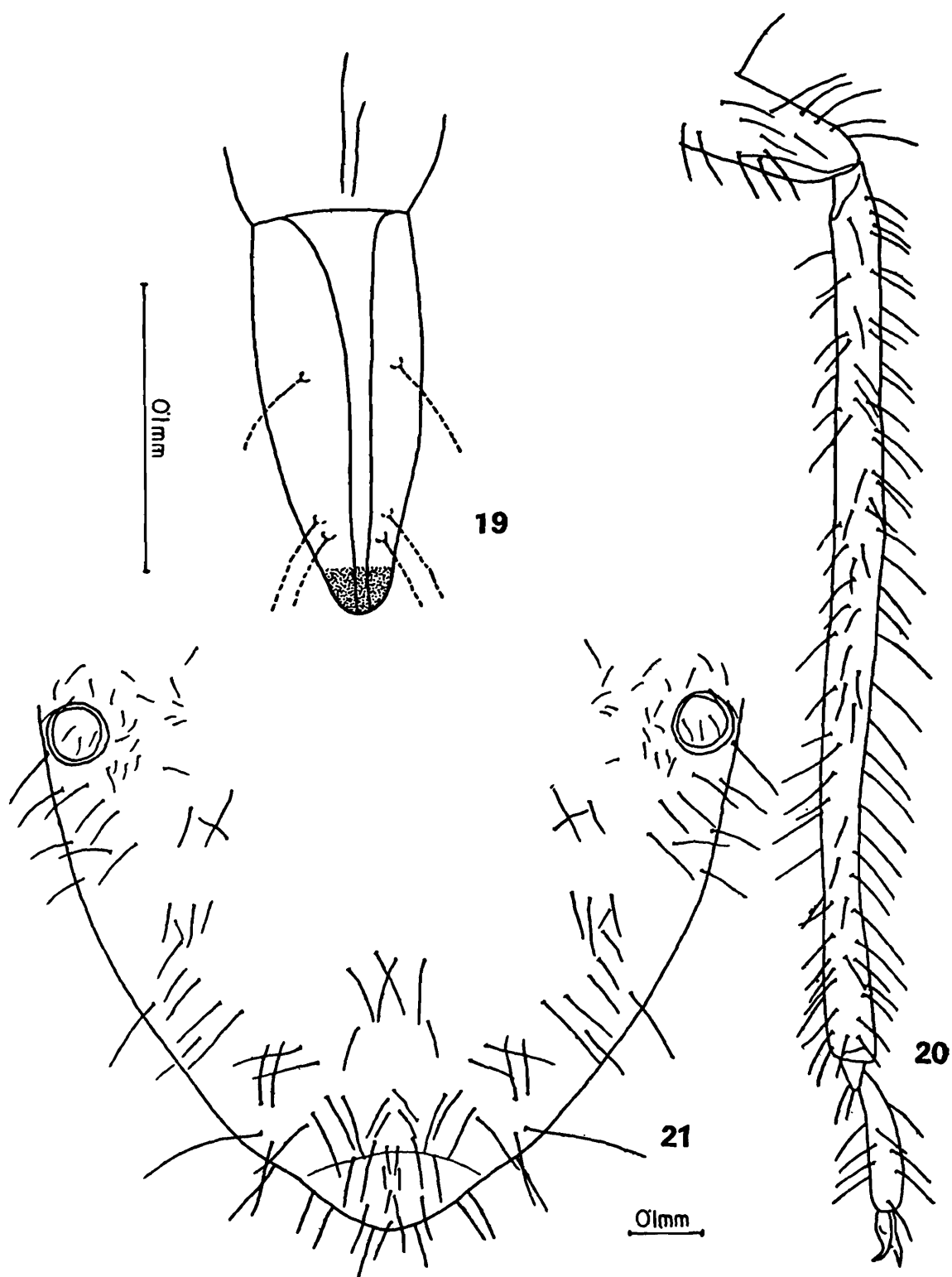
	Length	Width	Antenna	Antennal segments				urs	ht ₂
				III	IV	V	VI		
1.	2.75	1.46	1.32	0.54	0.24	0.21	(0.12+ 0.06)	0.14	0.20
2.	2.89	1.44	1.38	0.62	0.24	0.23	(0.16+ 0.06)	0.15	0.22

(1, ex *Machilus odoratissima*, Tronglaobi, Manipur, 3.ii.1969, C.U.
2, ex *Machilus odoratimmima*, Tranglaobi, Manipur, 24.v.1974. C.U.)

Alate viviparous female: Body 2.48—2.65 mm long with 0.90—1.15 mm as maximum width. Head brown; dorsal cephalic hairs



Aiceona (Subaiceona) manipurensis Singh & Raychaudhuri. Apterous viviparous female : 17, head ; 18, antenna.



Apterous viviparous female : 19, ultimate rostral segment, 20, hind leg (part);
21, posterior portion of abdomen.

fine, 0.103—0.163 mm long, upto $3.5\text{--}5.4\times$ as long as the basal diameter of antennal segment III. Eyes with distinct ocular tubercles. Antennae 6-segmented, $0.58\text{--}0.60\times$ as long as the body; flagellum imbricated which appear to form distinct cells near base of segment III; hairs on the flagellum fine, 0.033—0.115 mm long, longest one on segment III, $2.3\text{--}3.6\times$ as long as the basal diameter of the segment, segment III with 31—36 and IV with 10—13 round to oval secondary rhinaria arranged irregularly; segment V with 2-5 similar rhinaria arranged in a row; processous terminalis $0.40\times$ as long as base of antennal segment VI. Abdominal dorsum pale; hairs on the dorsum of abdomen fine, 0.083—0.115 mm long, longest one on anterior tergites $2.7\text{--}3.8\times$ as long as the basal diameter of antennal segment III; 8th tergite with 8-12 hairs upto 0.146—0.163 mm long. Siphunculi present on elevated hairy cones. Cauda with 8-10 hairs. Legs blackish brown to black with tarsi and apices of tibiae paler; both femora and tibiae smooth, bearing many fine hairs 0.050—0.130 mm long; first tarsal segments with 7-8 hairs; second tarsal segments distinctly imbricated. Forewings with media twice branched, subcosta bearing a row of hairs; radial sector nearly straight; hind wings with both obliques.

Colour : Yellowish brown in life.

Measurements in mm :

	Length	Width	Antenna	Antennal segments				urs	ht ₂
				III	IV	V	VI		
1.	2.48	0.96	1.83	0.65	0.34	0.29	(0.15+ 0.06)	0.17	0.20
2.	2.62	1.13	1.58	0.62	0.27	0.27	(0.15+ 0.06)	0.16	0.21

(1, ex *Machilus odoratissima*, Tronglaobi, Manipur, 24.v.1974, C.U.,
2, ex *Machilus odoratissima*, Tronglaobi, Manipur, 3.ii.1969, C.U.).

Nymph (Apterous: early stage): Body pale, elongate 1.51 mm long with 0.69 mm as its maximum width. Dorsal cephalic hairs 0.066—0.115 mm long, fine and acute. Antennae pale, pubescent, 6-segmented, $0.72\times$ as long as the body; hairs on the flagellum fine, acute, 0.040—0.070 mm long; processus terminalis $0.060\times$ as long as base of segment VI. Rostrum reaches near hind coxae,

ultimate rostral segment slender, $0.92 \times$ as long as second segment of hind tarsus and bears 4 long fine accessory hairs, upto 0.066 mm long. Abdominal dorsum pale, membranous ; hairs on the dorsum of abdomen fine, on anterior tergites 0.050—0.010 mm long, on 8th tergite 0.115—0.130 mm long; 8th sternite with a spine-like hair besides fine hairs. Siphunculi with large pores surrounded by many hairs. Cauda with 4 hairs. Legs pale, pubescent; hind legs longer than the body, longest hair on hind tibiae upto 0.100 mm long.

Colour : Pale green in life.

Measurements in mm:

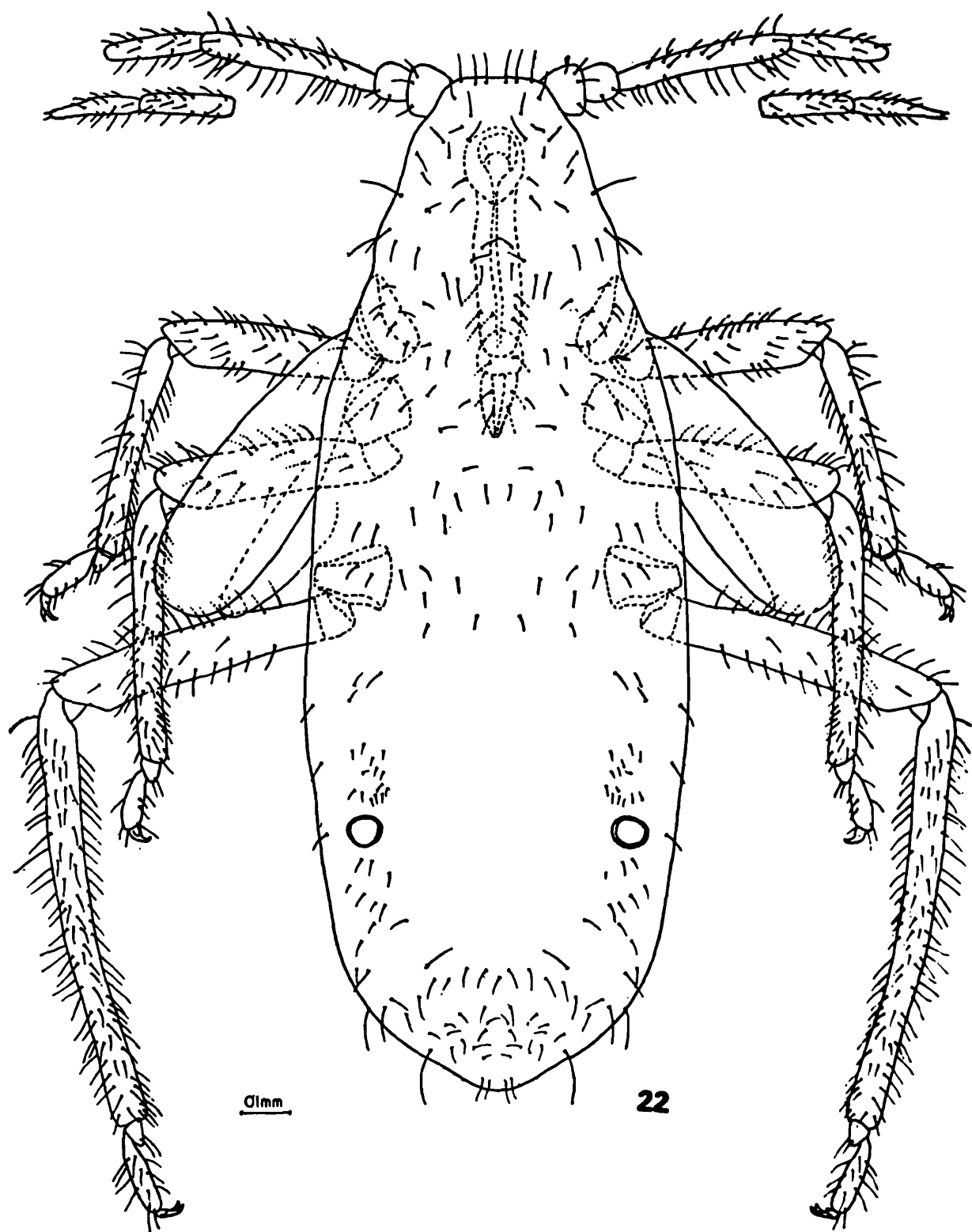
Length	Width	Antenna	Antennal segments				urs	ht ₂
			III	IV	V	VI		
1.51	0.69	1.10	0.33	0.18	0.20	(0.115+ 0.070)	0.16	0.18

(ex *Machilus odoratissima*, Tronglaobi, Manipur, 24.v :1974, C.U.)

Material examined One apterous viviparous female, one alate viviparous female and two nymphs from *Machilus odoratissima*, Tronglaobi, Manipur, India, 3.ii.1969, Coll. T. K. Singh (Holotype and Paratypes; C.U. Colls.); One apterous viviparous female, one alate viviparous female and 4 nymphs from *Machilus odoratissima*, Tronglaobi, Manipur, India, 24.v.1974, Coll. T. K. Singh (Paratypes; C.U. Colls).

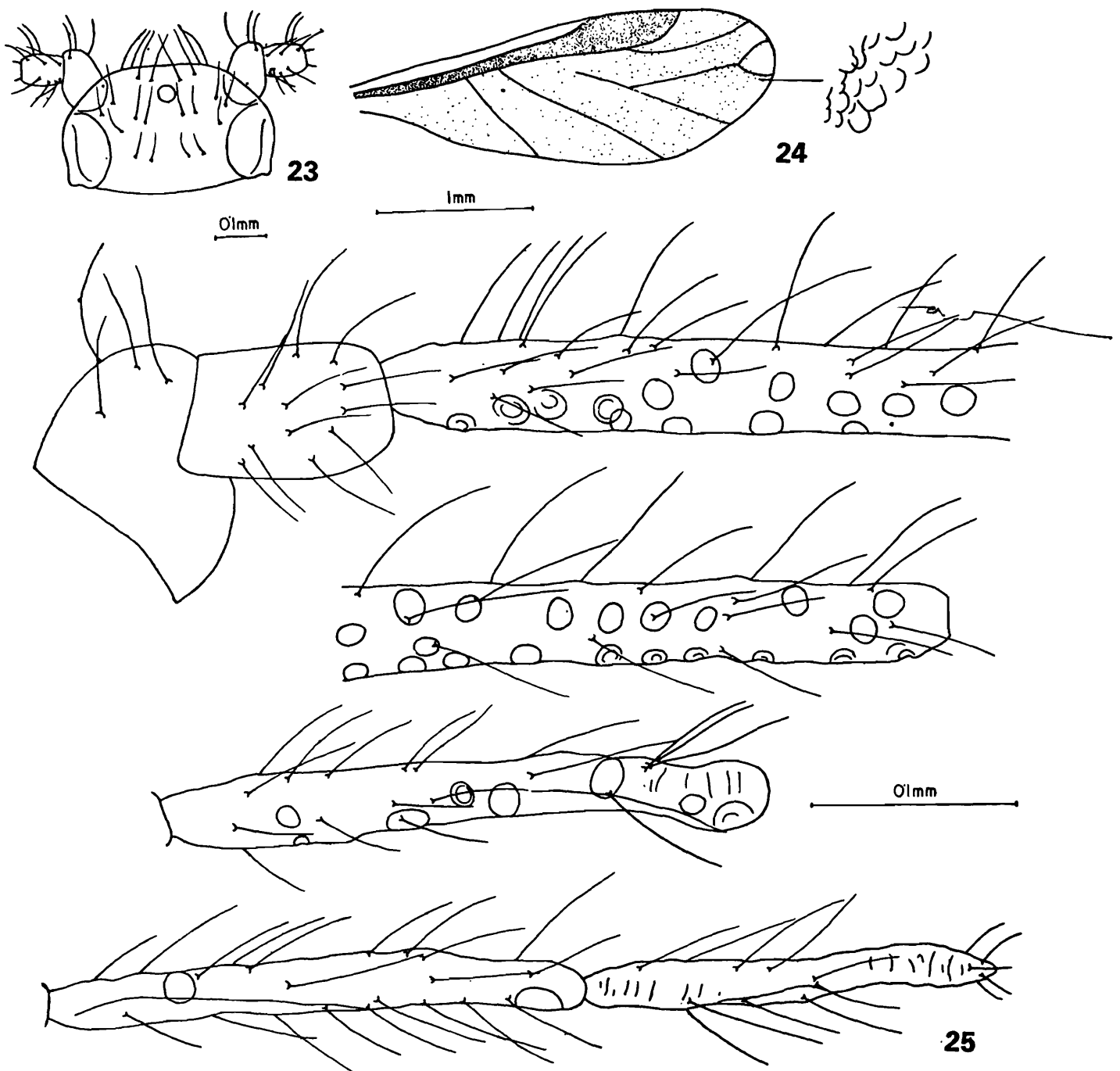
Discussion : The species seems to be restricted to *Machilus* and from the collection records, appears to be at the peak of infestation during the months of February to May. Infestation is reported to be heavy on young stems and undersurface of leaves of the plants. Red ants were noted to visit the species. Although several collections from plants of Lauraceae including from *Machilus* have been made from other areas of northeastern region, this species is known so far only from the state of Manipur.

Distribution : India: Manipur.

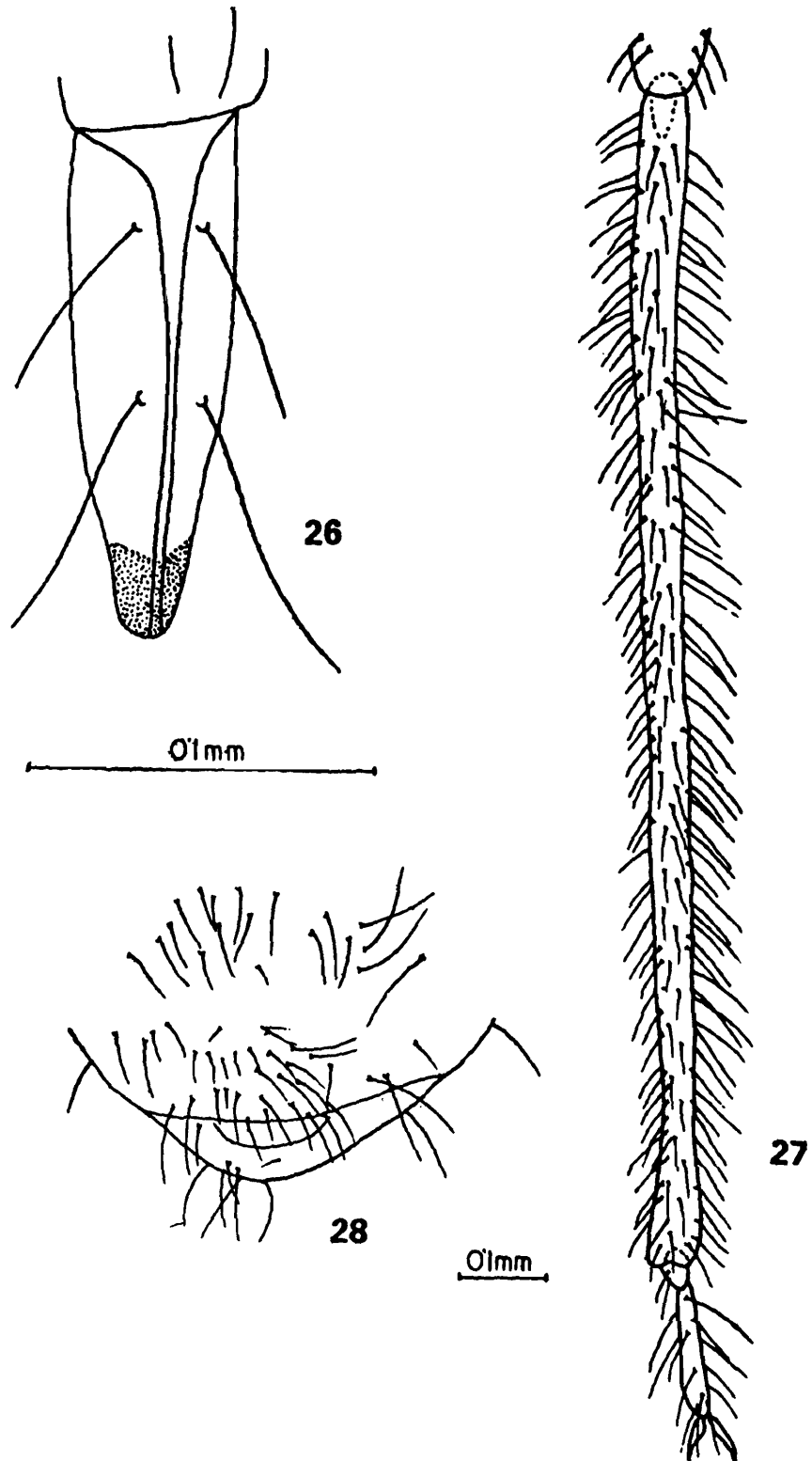


Apterous nymph : 22, whole body.

Types : In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India.



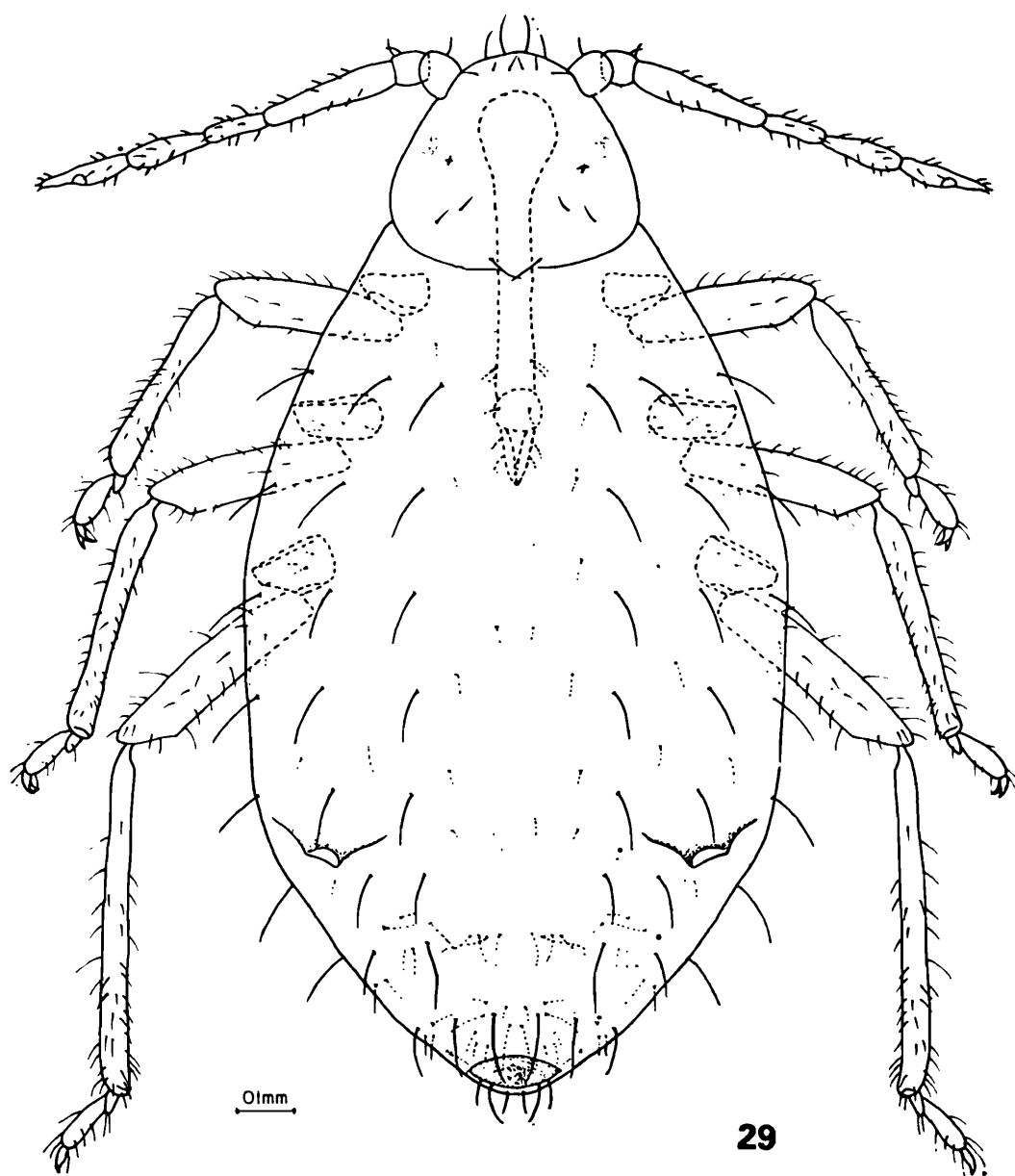
Alate viviparous female : 23, head ; 24, forewing ; 25, antenna.



Alate viviparous female : 26, ultimate rostral segment ; 27, part of hind leg ;
28, caudal region.

5. *Aiceona pallida* Ghosh and Raychaudhuri
(Figs. 29—40)

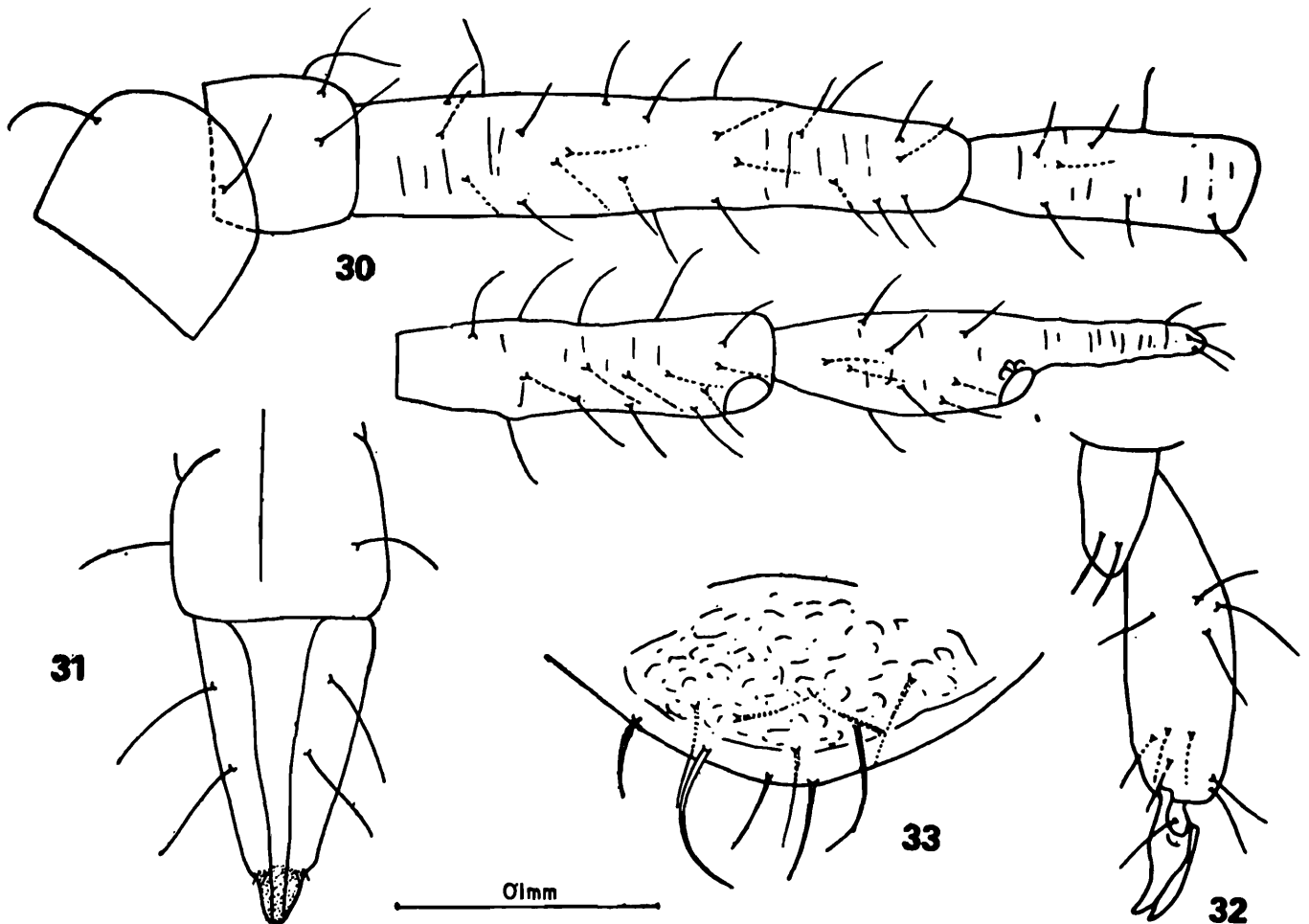
1972. *Aiceona pallida* Ghosh, A. K. and Rachaudhuri, D. N., *Proc. zool. Soc. Calcutta*, **25** : 105.
1976. *Aiceona pallida*, Eastop, V. F. and Hille Ris Lambers, D., *Survey of the World's Aphids*, 19.
1973. *Aiceona pallida*, Ghosh, M. R. and Raychaudhuri, D. N., *Orient. Insect*, **7** (4) : 552.



Aiceona pallida Ghosh & Raychaudhuri, Apterous viviparous female : 29,
whole body.

1980. *Aiceona pallida*, Raychaudhuri, D. N., Pal, P. K., Ghosh, A. K. *In* Aphids of North East India and Bhutan, 43.

Apterous viviparous females: Body pale, 2.3—2.7 mm long with 1.1—1.2 mm as maximum width. Head pale; dorsal cephalic hairs fine, upto 0.080—0.11 mm long. Antennae 6-segmented, 0.55—0.60 $\times$ as long as the body; flagellum feebly imbricated; hairs on the flagellum fine, 0.02—0.04 mm long, longest one on antennal segment III, 1.0—1.1 $\times$ as long as the basal diameter of the segment; processus terminalis 0.50—0.55 $\times$ as long as base of segment VI. Rostrum reaches little beyond mid coxae, ultimate rostral segment 0.95—1.0 $\times$ as long as the second segment of hind tarsus and bears 6 long fine hairs (0.04—0.060 mm) besides 3-4 short hairs (0.018—0.021 mm). Abdominal dorsum pale, except at dusky



Apterous viviparous female : 30, antenna ; 31, ultimate rostral segment ; 32, hind tarsus ; 33, caudal region.

sclerotic bases of hairs; hairs on the dorsum of abdomen fine, on anterior tergites 0.09—0.11 mm long, $2.0\text{--}2.5\times$ as long as the basal diameter of antennal segment III, on posterior tergites 0.012—0.14 mm long, $2.5\text{--}3.2\times$ as long as the mentioned diameter; 8 tergite with 6 hairs, of which the spinal ones are 0.12—0.14 mm long. Siphunculi pale, sometimes little dusky, siphuncular pore 0.06 mm, in diameter surrounded by a number of fine, thin hairs (0.04—0.05 mm long). Cauda with 8-9 hairs, legs pale, light brownish, hairs on femora end tibiae long fine besides some short, erect ones, longest hair on hind tibiae 0.06 mm long, $1.1\text{--}1.2\times$ as long as the diameter at the middle of the tibia; first tarsal segments with 5, 5, 5 hairs.

Colours: Creamy yellow to dirty grey in life.

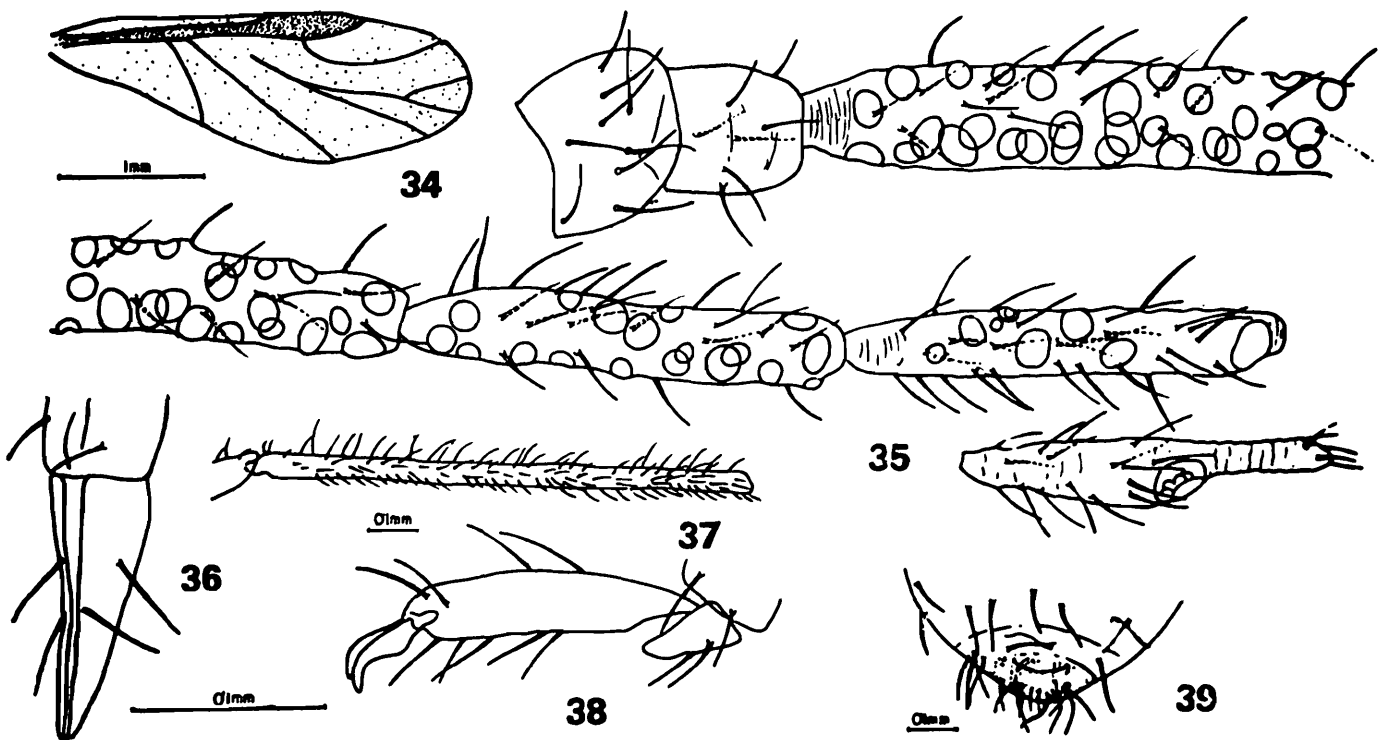
Measurements in mm:

	Length	Width	Antenna	Antennal segments				urs	ht ₂
				III	IV	V	VI		
1.	2.4	1.01	1.30	0.45	0.24	0.25	(0.18+ 0.09)	0.18	0.18
2.	2.10	1.08	1.35	0.50	0.23	0.24	(0.14+ 0.08)	0.16	0.17

(1, 2, ex Indet—host, Algarah, Darjeeling Dist., W.B., 8.i.1971, C.U.).

Alate viviporous female: Body 2.3—2.7 mm long with 0.85—1.0 mm as maximum width. Head and thorax dark brown; dorsal cephalic hairs 0.05—0.09 mm long, upto $2.0\text{--}2.8\times$ as long as the basal diameter of antennal segment III. Antennae dark brown, $0.61\text{--}0.64\times$ as long as the body; flagellum imbricated; hairs on the flagellum 0.028—0.038 mm long, erect, thin, upto $1.2\text{--}1.5\times$ as long as the basal diameter of antennal segment III; segment III with 50-66, IV with 16-25, V with 6-14, protruberant secondary rhinaria distributed over their entire length; processus terminalis $0.44\text{--}0.50\times$ as long as base of antennal segment VI. Rostrum reaches beyond mid coxae, ultimate rostral segment equal to second segment of hind tarsus. Abdominal dorsum pale, bearing broad, dark brown, segmental, minutely spiculose spino-pleural

sclerotic bands on 1st-7th tergites besides sclerotic stigmal plates and small scleroites scattered in between transverse bands; hairs on the dorsum of abdomen somewhat thick, acute at apices, on anterior tergites upto 0.087—0.093 mm long, $3.5\text{--}4.0\times$ as long as the basal diameter of antennal segment III, on posterior tergites upto 0.13—0.14 mm long, $5.4\text{--}5.6\times$ as long as the mentioned diameter, marginal hairs usually 0.085—0.090 mm long. Sphunculi on dark brown cones. Cauda with 9-10 hairs. Legs brown to dark brown, sometimes paller near bases of femora, hairs on femora long, fine (0.078—0.097 mm), on tibiae shorter and thicker, 0.056—0.078 mm long. Wings pale, pterostigma dark brown.



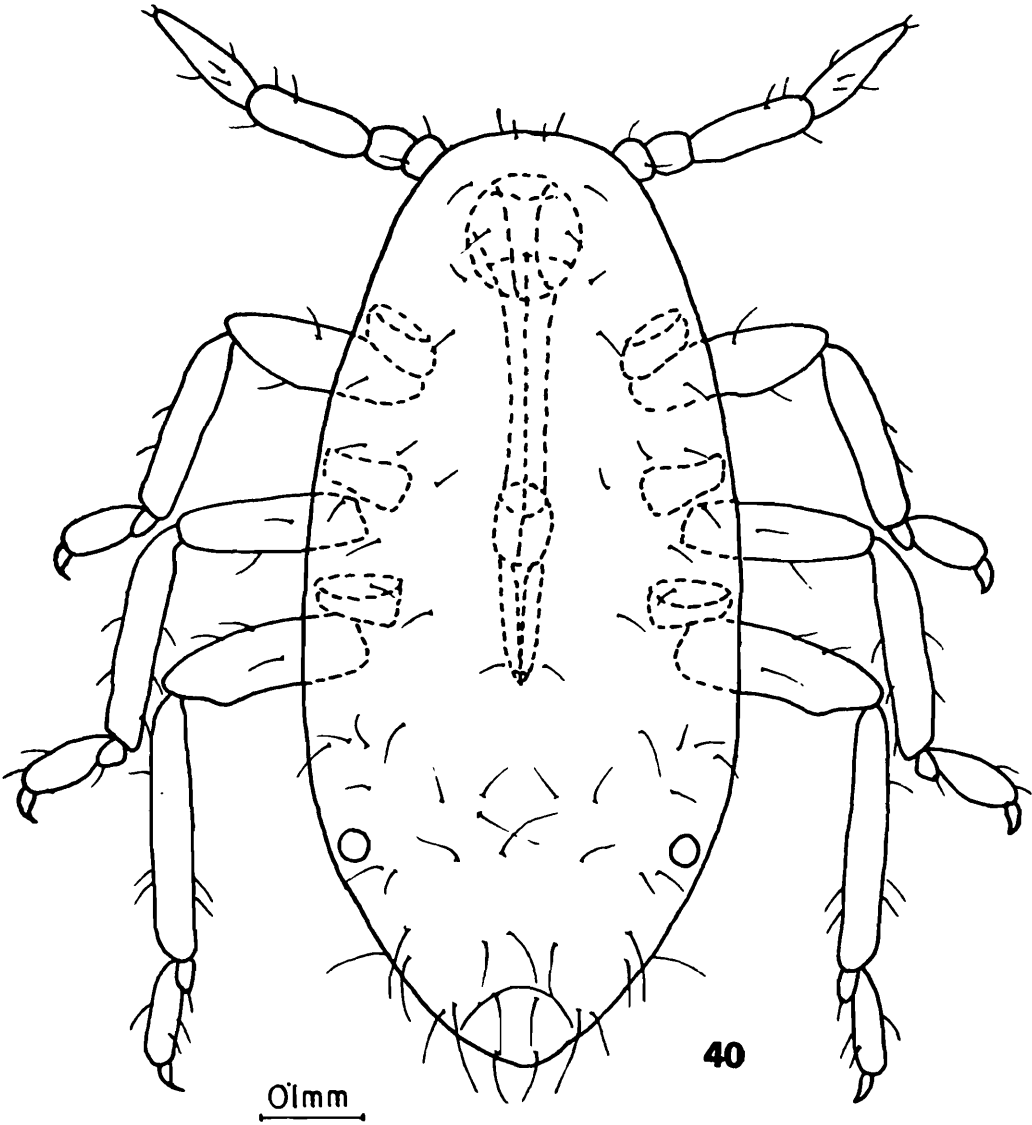
Alate viviparous female, 34, forewings ; 35, antenna ; 36, ultimate rostral segment ; 37, hind tibia ; 38, hind tarsus ; 39, caudal region.

Colour: Cream coloured in life with dark head and abdomen.

Measurements in mm:

	Length	Width	Antenna	Antennal segment				urs	ht ₂
				III	IV	V	VI		
1.	2.6	1.0	1.6	0.72	0.28	0.29	(0.16+ 0.08)	0.16	0.17
2.	2.7	1.1	1.7	0.74	0.29	0.29	(0.16+ 0.08)	0.17	0.17

(ex indet. host, Algarah, Darjeeling Dist., W.B., 8.i.1971, C.U.).



Apterous nymph ; 40, whole body.

Material examined: Many apterous and alate viviparous females from indet hosts, Algarah (*c* 1833m), Monsung (*c* 1668m), Kameshi (*c* 900 m), Kurseong (*c* 1555 m), Lamahat (*c* 2000 m) Darjeeling district, West Bengal, Jan.-July, 1965-1970, Colls. M.R. Ghosh (C.U. Colls.); Two apterous viviparous females from *Machilus villosa*, Darugiri, Garo Hills, Meghalaya, India, 10.v.1973 (ZSI Colls.).

Discussion: These insects form colonies on tender shoots, mostly on undersurface of copper coloured leave of unidentified host-plants. The infested leaves roll-up along the length of blades. These insects secrete profuse honey dew and often remain covered by white powdery substance. Ant attendance is common. This species can easily be separated from allied species by the key.

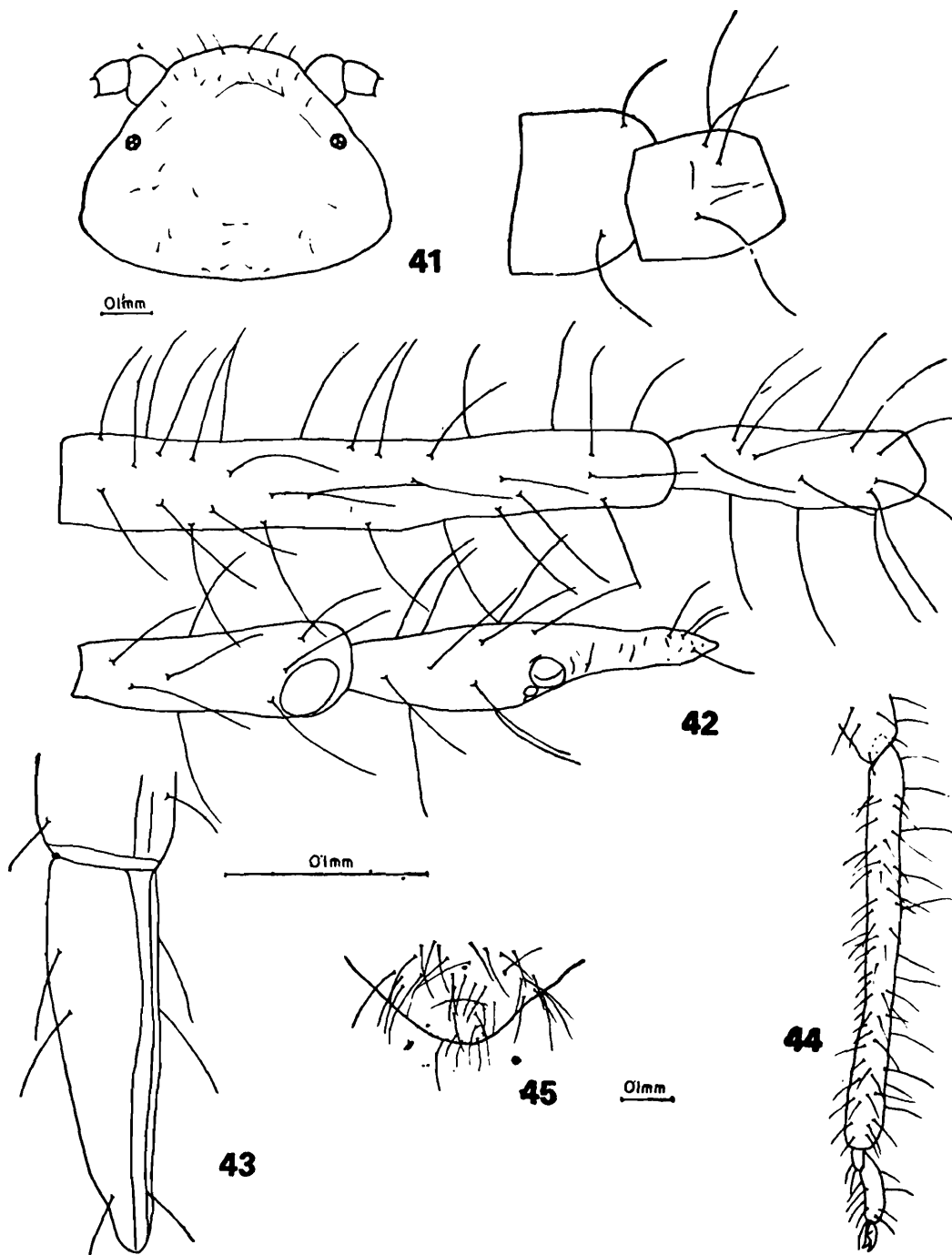
Distribution: India: West Bengal (Darjeeling District), Meghalaya.

Types: In the collection of Entomology Laboratory, Department of Zoology, University of Calcutta, India.

5. *Aiceona paraosugii* Ghosh, Ghosh and Raychaudhuri (Figs. 41-52)

1971. *Aiceona paraosugii* Ghosh, A. K., Ghosh, M. R., Raychaudhuri, D. N., *Orient Insects*, 5 : 324.
1973. *Aiceona paraosugii*, Ghosh, M. R., Raychaudhuri, D. N., *Orient. Insects*, 7 (4) : 552.
1976. *Aiceona paraosugii*, Eastop, V. F. and Hille Ris Lambers, D., *Survey of the World's Aphids*, 19.
1977. *Aiceona paraosugii*, Pal, P. K. and Raychaudhuri, D. N., *Orient Insects*, 1 (3) : 376.
1980. *Aiceona paraosugii*, Basu, R. C. and Raychaudhuri, D N., *Rec. Zool. Surv. India Misc. Publ.*, 18 : 4.
1980. *Aiceona paraosugii*, Raychaudhuri, D. N., Pal, P. K., Ghosh, A. K. *In Aphids of North East India and Bhutan*, 43.

Apterous viviparous female: Body 2.2—2.3 mm long with 1.0—1.1 mm as maximum width. Head pale; dorsal cephalic hairs fine, acute, 0.083—0.130 mm long, $2.6\text{--}3.3\times$ as long as the basal diameter of antennal segment III. Antennae 6-segmented, 0.40—



Aiceona paraosugii Ghosh, Ghosh, Raychaudhuri. Apterous viviparous female : 41, head ; 42, antenna ; 43, ultimate rostral segment ; 44, part of hind leg ; 45, caudal region.

0.44× as long as the body; flagellum smooth on basal 0.66 portion of segment III, rest sparsely and feebly imbricated except processus terminalis which is distinctly imbricated; hairs on the flagellum fine, 0.07—0.106 mm long, 1.7—2.5× as long as the basal diameter of antennal segment III, a few short ones about equal to the mentioned diameter; processus terminalis 0.50—0.58× as long as the base of antennal segment VI. Rostrum reaches near hind coxae, ultimate rostral segment slender, 1.35—1.4, as long as second segment of hind tarsus and bears 8 accessory hairs. Abdominal dorsum pale, hairs on the dorsum of abdomen fine, very long, (0.150—0.187 mm), on anterior tergites 5.0—5.5× and on posterior tergites 5.5—6.5× as long as the basal diameter of antennal segment III, respectively; marginal hairs not separable from other dorsal hairs; 8th tergite with 7-8 long, fine hairs upto 0.198 mm long. Siphunculi on pale yellow cones, surrounded by 12-15 long, fine hairs, cauda semi-oval with 6-8 hairs. Legs pale; hairs on femora and tibiae of variable length, tibiae being more pubescent than femora, longest hair on hind tibiae upto 0.130 mm long, 2.0× as long as the diameter at the middle of the tibia; first tarsal segments with 6+1, 6+1, 6+1 hairs.

Colour: Cream-coloured in life.

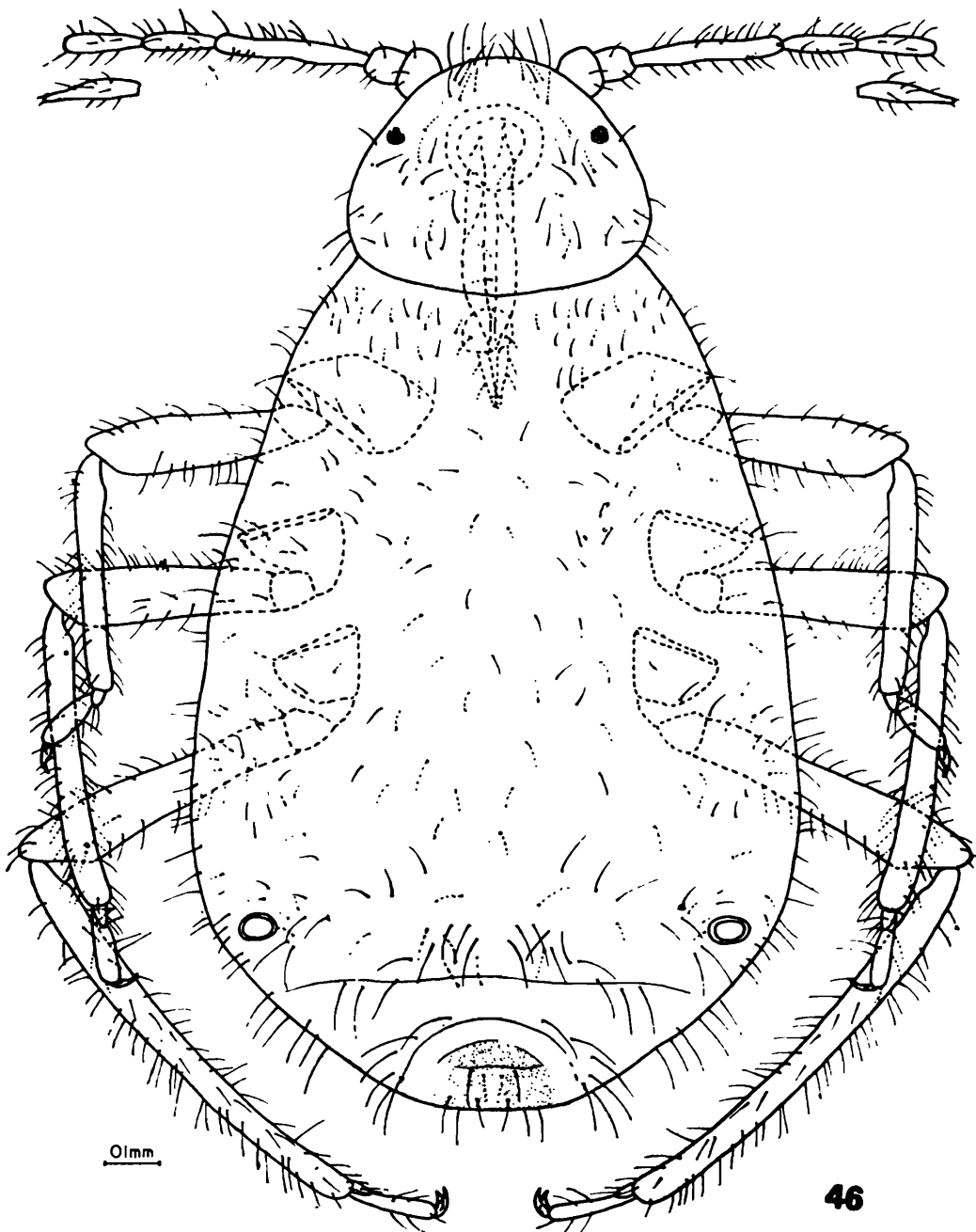
Measurements in mm:

	Length	Width	Antenna	Antennal segment				urs	ht ₂
				III	IV	V	VI		
1.	2.3	1.2	1.01	0.30	0.13	0.13	(0.11+ 0.16)	0.21	0.15
2.	2.4	1.3	0.95	0.34	0.13	0.15	(0.12+ 0.07)	0.23	0.14

(ex unidentified tree, Lava, Darjeeling District, W.B., 30.vi.1969, C.U.).

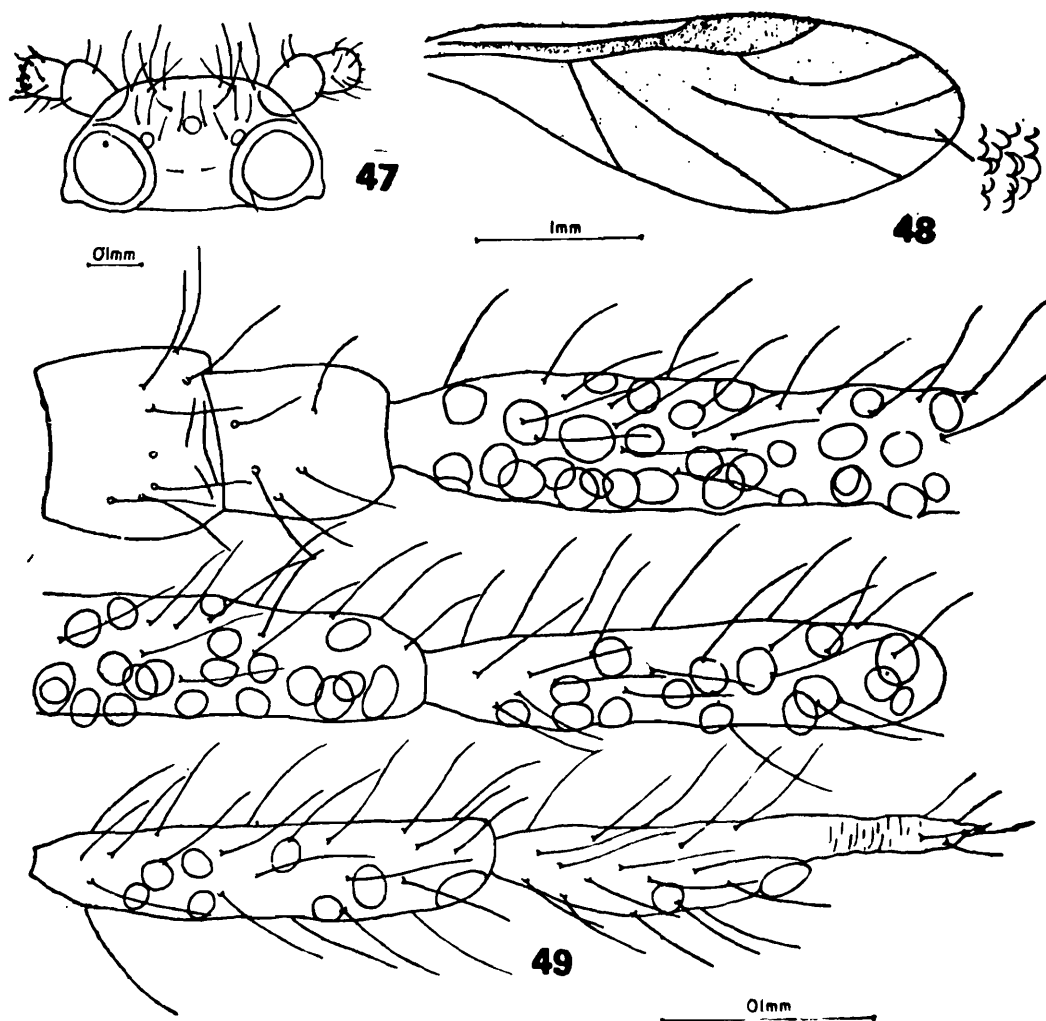
Alate viviparous female: Body 2.20 mm long with 0.97 mm as maximum width. Head dark brown. Antennae 6-segmented, dark brown, 0.45× as long as the body; flagellum with distinctly reticulated imbrications, except processus terminalis which is with normal imbrications; hairs on flagellum stiff, flagellate near apices, 0.050—0.066 mm long, 2.0—3.0× as long as basal diameter of

antennal segment III; segment III with 43-45, IV with 12-13 and V with 6-7 and base of segment VI with one protuberant secondary rhinaria; processus terminalis little over half the length of base of segment VI. Rostrum reaches beyond mid coxae, ultimate rostral segment somewhat stillete-shaped, $1.25\times$ as long as second segment of hind tarsus and bears at least 3 pairs of long, fine, accessory hairs. Abdominal dorsum pale bearing broad, brown, segmental spinal

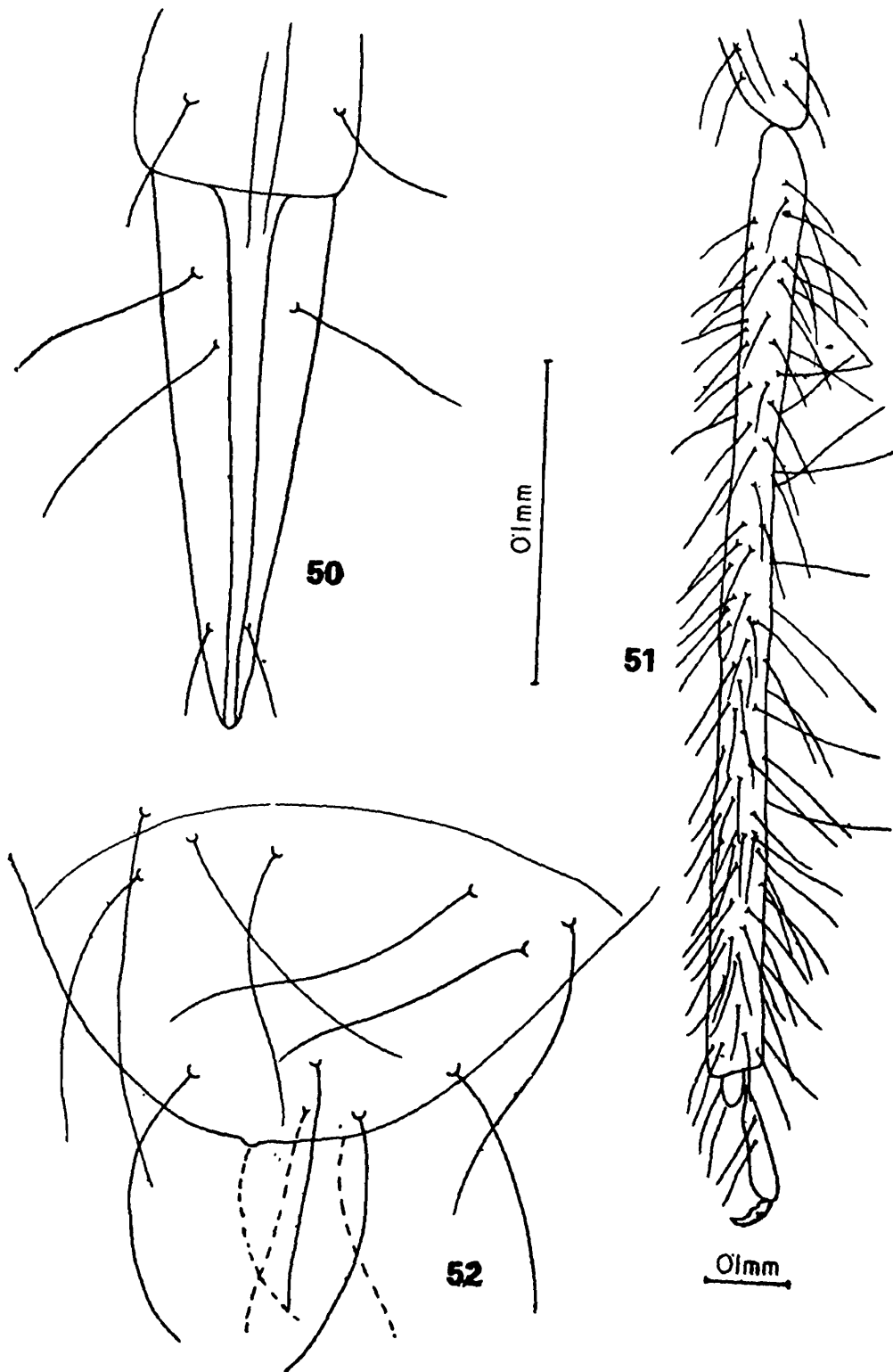


Apterous nymph : 46, whole body.

sclerites on 1st-8th tergites, besides pale, rather broken marginal sclerites; hairs on the dorsum of abdomen long, fine, spinal ones upto 0.125–0.150 mm long, $6.7\text{--}8.3\times$ as long as the basal diameter of antennal segment III, marginal hairs upto $5.5\text{--}6.0\times$ as long as the mentioned diameter. Siphunculi on brown sclerotic cones bearing 14-15 fine hairs. Cauda pale, with 6 hairs. Legs concolourous with the antennae; femora with many fine hairs, upto $4.0\text{--}6.0\times$ as long as the basal diameter of antennal segment III; hairs on tibiae numerous, fine, longest one on hind tibiae, 0.163 mm long, $2.5\times$ as long as the diameter at the middle of the tibiae; first tarsal segments each with 6 fine hairs and one short sense peg. Wing venation normal; subcosta in forewings with about 25 hairs, along the entire length.



Alate viviparous female : 47, head ; 48, forewing ; 49, antenna.



Alate viviparous female : 50, ultimate rostral segment ; 51, part of hind leg ;
52, caudal region.

Colour: Cream brown with darker appendages.

Measurements in mm:

	Length	Width	Antenna	Antennal segments				urs	ht ₂
				III	IV	V	VI		
1.	2.2	0.97	1.2	0.44	0.25	0.23	(0.15+ 0.08)	0.20	0.16

(ex unidentified tree, Lava, Darjeeling District, W.B., 30.vi. 1969, C.U.).

Alate oviparous female: Body elongate, slender 2.50 mm long with 0.90 mm as maximum width. Head dark brown; dorsal cephalic hairs fine, 0.083—0.115 mm long, $3.5-5.0\times$ as long as the diameter at the constricted base of antennal segment III. Antennae dark, 6-segmented, $0.50\times(0.54\times)$ as long as the body; flagellum with reticulated—imbrications as in viviparae; segment III with 37-42, IV with 12-16, V with 7 and VI with 1 secondary rhinaria; processus terminalis $0.71\times$ as long as base of segment VI. Ultimate rostral segment fine, $1.40\times$ as long as second segment of hind tarsus. Abdominal dorsum pale bearing broad, brown sclerites on 1st-8th tergites besides irregular, hair bearing marginal sclerites; dorsal hairs fine, 0.083—0.130 mm long; 8th tergite with about (?) 7 long, flagellate hairs. Siphunculi on brown sclerites bearing 11-12 hairs. Genitalia as in (fig.). Legs dark brown; femora with long fine hairs; hairs on hind tibiae fine, flagellate (0.130—0.163 mm) on outer margin, thick spine-like on inner margin (0.033—0.050 mm). Forewings with media twice branched; hind wings with both obliques.

Colour: Brown in life.

Measurements in mm:

	Length	Width	Antenna	Antennal segments				urs	ht ₂
				III	IV	V	VI		
	2.50	0.90	1.24	0.44	0.22	0.21	(0.14+ 0.10)	0.26	0.18

(ex Yellow Pan Trap, Kalimpong, W.B., Feb., 1970, C.U.).

Material examined: Two apterous viviparous female and one alate viviparous female (Types) from unidentified host-plant, Kulbang forest, Lava, Darjeeling district, West Bengal, India, 30.vi.1969; Coll. M.R. Ghosh (C.U. Colls); one alate oviparous female from yellow pan Water Trap, Kalimpong, West Bengal, Feb. 1970, (C.U. Colls.).

Discussion: Ghosh, *et al.* (1970) pointed out similarity of present species with Japanese *osugii* Takahashi, 1924, but shorter antenna, longer rostrum and fewer secondary rhinaria in alatae help to separate out the species. The species appears to be rare in occurrence as hardly any colony has been recorded after the original description was published. Small cream-coloured insects infest under surface of young leaves of the host-plants. Ants were recorded to visit these insects.

Distribution: India: West Bengal.

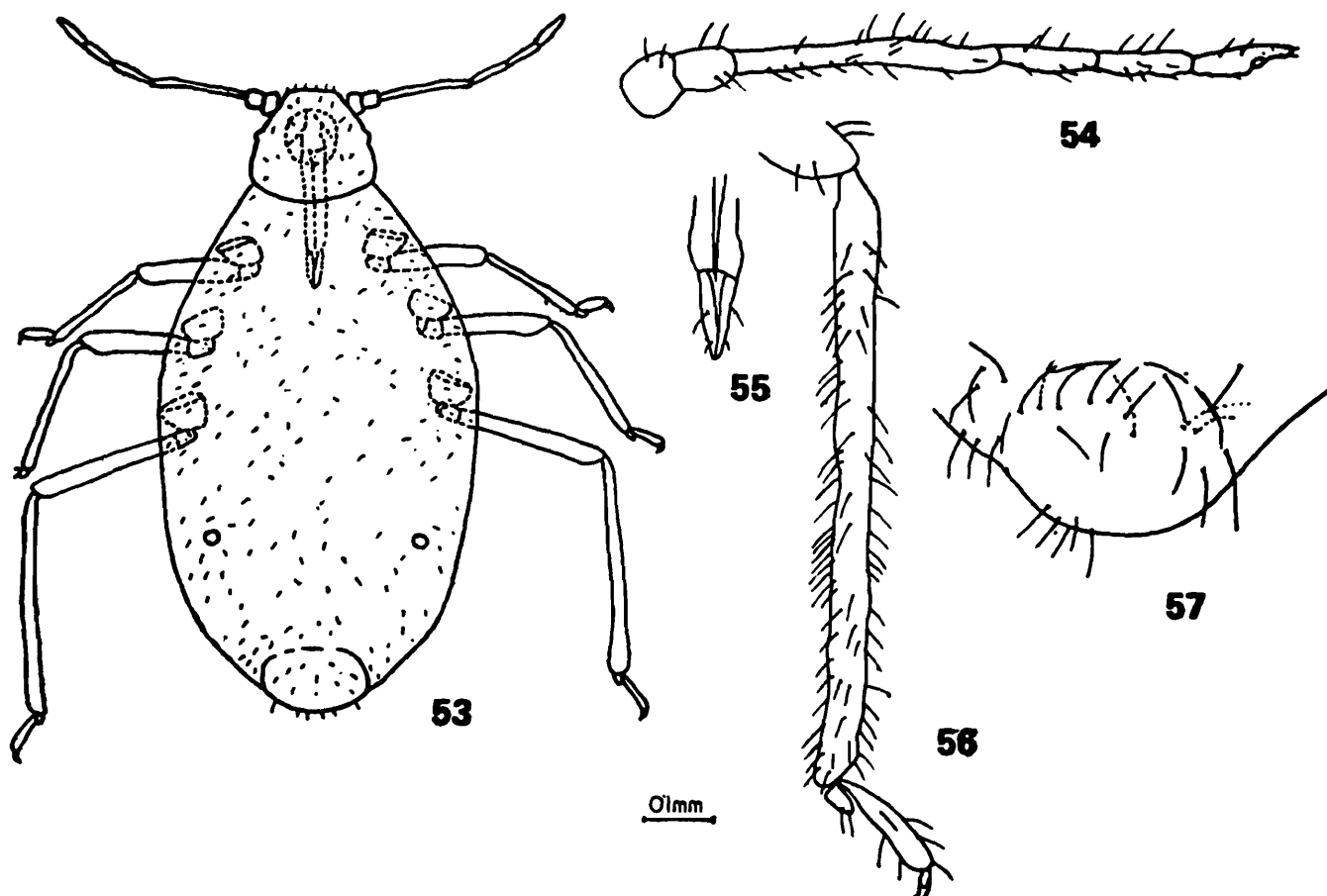
Types: In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India.

7. *Aiceona parvicornis* Miyazaki (Figs. 53-64)

1977. *Aiceona parvicornis* Miyazaki, Masahisa, *Kontyu*, **45** (2) : 204.

Apterous viviparous female: Body 2.6—3.05 mm (2.90 mm) long, elliptical. Head brown, smooth, with a median suture; dorsal cephalic hairs fine (0.083—0.115 mm long) about 22-25 in each side; a pair of small wax plates composed of 2-6 facets present dorso-mesially, on the head. Antennae 6-segmented, pale brown, 0.41—0.43 × as long as the body; flagellum imbricated; hairs on flagellum 0.033—0.066 mm long, 1.0—2.0 × as long as the basal diameter of antennal segment III; processus terminalis 0.42—0.50 × as long as base of antennal segment VI. Rostrum reaches beyond midcoxae, ultimate rostral segment 0.76—0.80 × as long as second segment of hind tarsus and bears 2-3 accessory hairs. Prothorax with a pair of large wax plates. Abdominal dorsum pale membranous with intersegmental aerolations, bearing scattered, small scleroites on 6th—8th tergites at the bases of hairs; hairs on the

dorsum of abdomen fine, upto 0.15 mm long; 8th tergite with 21-23 hairs. Siphunculi on small sclerotic cones bearing 13—19 hairs. Cauda broadly rounded, surrounded with small denticles forming a reticulate pattern and bearing 4-6 hairs. Legs with numerous hairs on femora and tibiae, longest one upto twice as long as the width at the middle of hind tibia; first tarsal segments with 6-7, 6-8, 6-9 hairs; second tarsal segments ventrally, sparsely spinulose.



Aiceona parvicornis Miyazaki. Apterous viviparous female : 53, whole body ; 54, antenna ; 55, ultimate rostral segment ; 56, part of hind leg ; 57, caudal region.

Colour: Not recorded in life.

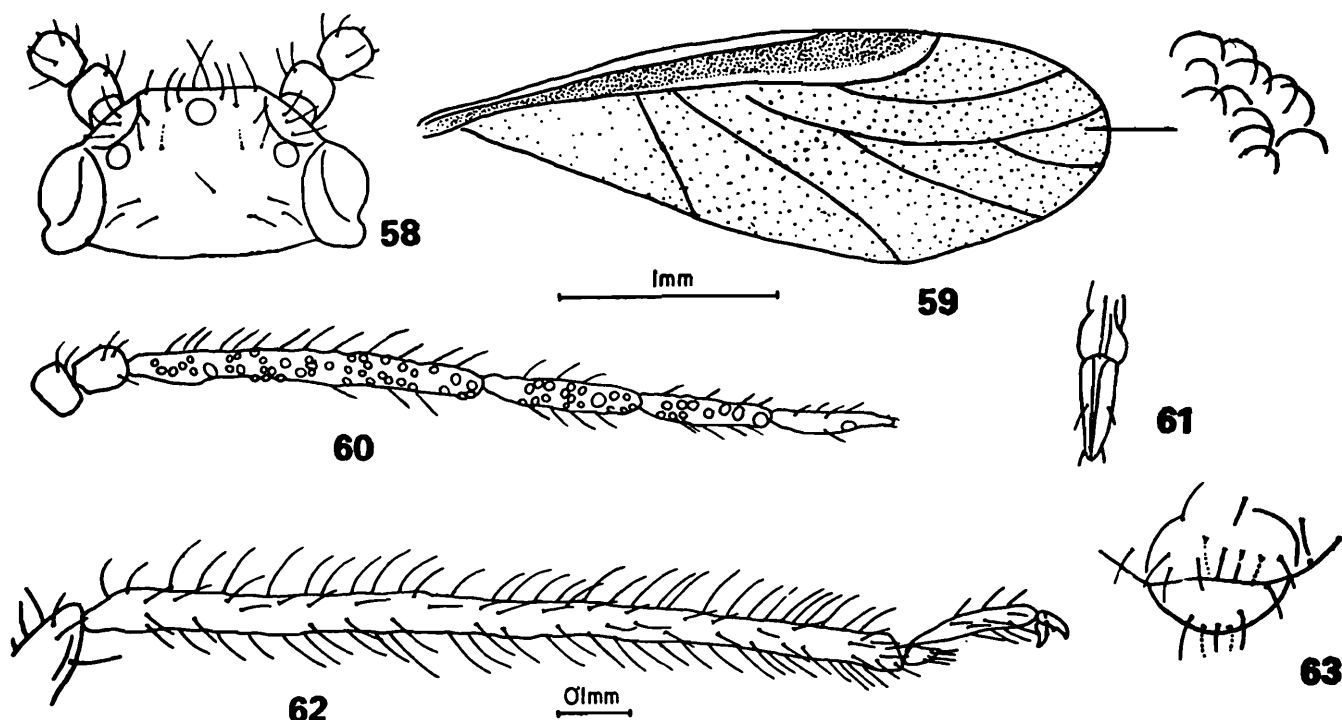
Measurements in mm :

	Length	Width	Antenna	Antennal segments				urs	ht _s
				III	IV	V	VI		
1.	2.90	1.30	1.12	0.45	0.16	0.15	(0.12+ 0.06)	0.16	0.20

2.	3.05	1.41	1.10	0.45	0.16	0.16	(0.14+	0.16	0.19
							0.06)		

(ex *Lindera pulcherrima*, Ulleri, Nepal, 12.v.1968, Hokk. Univ.).

Alate viviparous female: Body about 2.6 mm long, Head with a median suture; dorsal cephalic hairs 14-15 on each side. Antennae dark brown, 6-segmented, $0.53\times$ as long as the body; hairs on flagellum 0.026—0.050 mm long, $1.0\text{--}1.9\times$ as long as the basal diameter of antennal segment III; segment III with 71-74, IV with 23-24, V with 10-13, rather large, protuberant secondary rhinaria distributed along their entire length; processus terminalis $0.46\times$ as long as base of antennal segment II. Ultimate rostral segment $0.80\times$ as long as second segment of hind tarsus. Abdominal dorsum bearing brown spino-pleural sclerotic band on 1st—7th tergites; dorsal hairs fine, flagellate, upto 0.130 mm long. 8th tergite sclerotic with about 18 hairs. Siphunculi on small brown cones bearing 3-4 hairs. Cauda with 6 hairs. Legs pubescent; longest hair on hind tibiae about $3.0\times$ as long as the diameter at the middle of the



Alate viviparous female ; 58, head ; 59, forewing ; 60, antenna ; 61, ultimate rostral segment ; 62, part of hind leg ; 63, Caudal region.

tibia; first tarsal segment with 7, 7, 7 hairs. Wings pale brown with subcosta and pterostigma darker; forewing with media twice branched, subcosta with many hairs upto 0.11 mm long.

Colour: Not recorded.

Measurements in mm:

Length	Width	Antenna	Antennal segments				urs	ht ₂
			III	IV	V	VI		
2.60	—	1.38	0.50	0.25	0.22	(0.13+0.06)	0.16	0.20

(ex *Lindera pulcherrima* Ulleri; Nepal, 12.v.1961 Hokkaido University)

Nymph (Apterous): Body pale elongate, 1.51 mm long with 0.67 mm as maximum width. Head pale, with a distinct median suture with 9-10 fine hairs on each side, a few upto 0.1000 mm long. Antennae pale, 5-segmented, segment IV and V feebly imbricated; hairs on flagellum fine, 0.023—0.040 mm long; processus terminalis 0.50× as long as base of last antennal segment. Rostrum reaches beyond hind coxae; ultimate rostral segment (45) nearly equal to second segment of hind tarsus (50) and bears 4 accessory hairs. Abdominal dorsum pale, bearing many fine hairs, upto 0.115 mm long. Siphunculi on pale cones bearing hairs. Legs pale; hairs on femora and tibiae fine, hind tibiae upto 0.050 mm long.

Colour: Not recorded.

Measurements in mm:

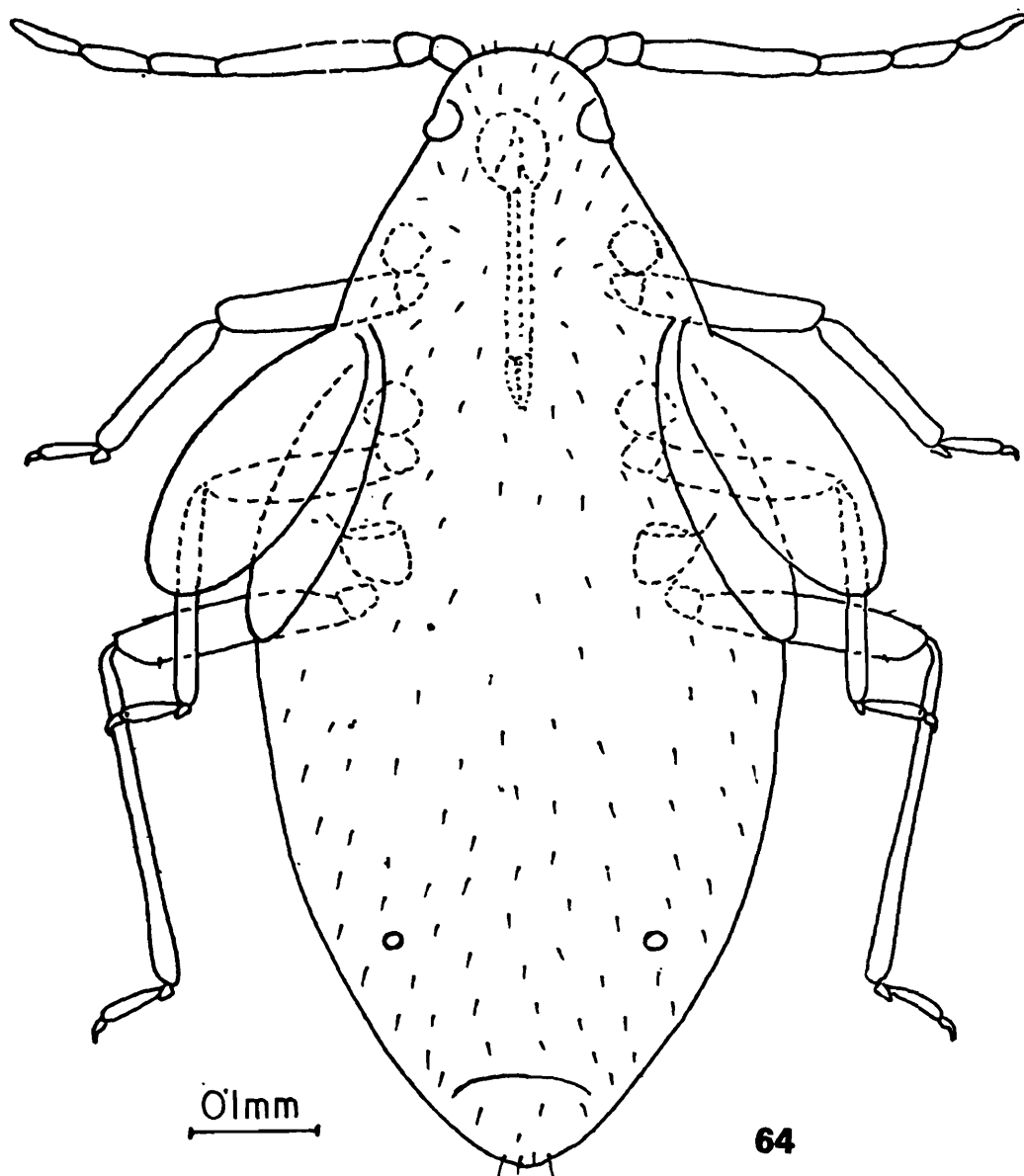
Length	Width	Antenna	Antennal segments			urs	ht ₂
			III	IV	V		
1.51	0.67	0.64	0.23	0.12	(0.10+0.05)	0.146	0.163

(ex *Lindera pulcherrima*, Ulleri No. 4, West Nepal, 12.v.1968, Hokk. Univ.).

Material examined: One apterous viviparous female, one alate viviparous female and 3 nymphs from *Lindera pulcherrima*, Ulleri

No. 4 West Nepal, 12.v.1968; Coll. T. Kumata (Syntypes: Hokkaido University Colls.).

Discussion: The spinal suture, scleroites on abdomen of apterae, ratio of urs , ht_2 and few accessory hairs on u.r.s., small siphuncular cones and numerous secondary rhinaria in alatae will make the species easily separable from others. No biological data is available for the species except its occurrence on *Lindera pucherrima* (Lauraceae), in the months of May at an altitude c 2010 m. in Nepal.



Alate nymph : 64, whole body.

Distribution : Nepal.

Types: In the collection of Entomological Institute, Hokkaido University, Sapporo, Japan.

8. *Aiceona pseudosugii* David, Sekhon and Bindra

1970. *Aiceona pseudosugii* David, S. K., Sekhon, S. S., Bindra, O. S., *Bull Ent.*, **11** (2) : 150.
1976. *Aiceona pseudosugii*, Eeastop, V. F. and Hille Ris Lambers, D., Survey of the World's Aphid, 19.

Apterous viviparous female : (Material not available ; description based on David et al., 1970). Body 2.9—3.0 mm long 1.5 mm as maximum width. Head smooth, with a distinct median suture ; dorsal cephalic hairs 0.08—0.16 mm long, $1.6\text{--}3.1\times$ as long as the basal diameter of antennal segment III. Antennae 6-segmented, pale, except processus terminalis, which is brown, about $0.66\times$ as long as the body ; flagellum smooth on segment III, faintly imbricated apicad ; hairs on the flagellum fine, 0.03—0.12 mm long, $0.60\text{--}2.4\times$ as long as the basal diameters of antennal segment III, base of segment VI with 16 hairs ; processus terminalis $0.40\text{--}0.50\times$ as long as base of segment VI. Eyes rudimentary, sometimes moderately developed. Rostrum reaches hind coxae ultimate rostral segment $0.80\times$ as long as second segment of hind tarsus and bears 6-8 accessory hairs, 0.07 mm long. Abdominal dorsum pale, pubescent ; hairs on the dorsum of abdomen fine, on anterior tergites 0.05—0.18 mm long, on posterior tergite upto 0.20 mm long, these being $1.0\text{--}3.6\times$ and $4.0\times$ as long as the basal diameter of antennal segment III, respectively ; 8th tergite with 8-10 hairs, upto 0.20 mm long. Siphunculi on pale sclerotic cones surrounded by many hairs and with a large opening, 0.10 mm wide. Cauda light brown, semicircular, with 10 hairs. Legs pale except hind tibiae which may be partly brown on outer margin ; femora and tibiae with numerous fine, flagellate hairs upto 0.18 mm long ; first tarsal segment with 9-11 hairs ; empodial hair $0.60\times$ as long as claws.

Colour : Not recorded.

Measurements in mm :

	Length	Width	Antennae	Antennal segment				urs	ht ₂
				III	IV	V	VI		
1.	2.90	1.4	1.9	0.75	0.35	0.34	(0.18+0.09)	0.20	0.25
2.	2.91	1.4	1.8	0.70	0.32	0.30	(0.18+0.09)	0.20	0.25

(1, 2, ex *Persea* (= *Machilus*) *odoratissima*, Nagrota, Himachal Pradesh, 19.v.1968).

Alate viviparous female : Body 2.7—3.3 mm long. Head pale brown. Antennae 6-segmented, pale brown, 0.60—0.71 × as long as the body ; segment III equal to segment IV+V, bearing 43—46 protuberant secondary rhinaria distributed over entire length, segment IV with 13—18 and V with 3—5 similar rhinaria ; processus terminalis 0.50 × as long as base of antennal segment VI. Abdominal dorsum with small, sclerotic spinal bars on 1st—3rd tergites. Legs with femora pale at base, brown in other portion, tibiae darker. Wing venation normal ; forewings with stigma, dark, bearing a series of long hairs, upto 0.95 mm long ; radial sector curved, media twice branched. Other characters as in apterae.

Colour : Not recorded.

Measurements in mm :

	Length	Antenna	Antennal segments			
			III	IV	V	VI
1.	3.29	1.99	0.75	0.39	0.35	(0.18+0.09)
2.	2.70	1.95	0.77	0.39	0.37	(0.18+0.09)

(1, 2, ex *Persea* (*Machilus*) *odoratissima*, Nagrota, Himachal Pradesh, 19.v.1968).

Discussion : Eastop and Hille Ris Lambers (1976) considered *longisetosa* M. R. Ghosh and Raychaudhuri, 1973, described from

Darjeeling District, West Bengal, India, as a synonym of *pseudosugii*. An analysis of morphological characters based on original description, as shown below, clearly indicates that *longisetosa* and *pseudosugii* are distinctly separable species.

	<i>pseudosugii</i>	<i>longisetosa</i>
1. Length	2.9—3.0	1.9—2.2
2. Dorsal cephalic	1.6—2.1	4.6—6.4
3. Antenna : brly	0.66 ×	0.34—0.38 ×
4. p.t. : base VI	0.40—0.50 ×	0.35 ×
5. Hairs on ant III : b.d. III	0.60—2.4 ×	4.0—5.0 ×
6. Hairs on base of VI	16	5—6
7. Hairs on u.r.s.	6—8	2
8. Hair on anterior tergites : b.d. III	3.6 ×	5.0—7.0 ×

Miyazaki (1977) described two new species of *Aiceona* from Nepal, of which *Aiceona himalaica* appears near to *pseudosugii*, differing largely in the fewer number of caudal hair (10 as against 17—19 in *himalaica*). Miyazaki (op.cit) mentioned that *himalaica* also differs from *pseudosugii* in having siphuncular cones “0.10—0.12 mm in longer axis” but original description states siphunculi with a large opening (not the cones) which is 0.10—0.12 mm in longer axes and David *et al.* (1970) also mentioned that siphunculi (in *pseudosugii*) are with wide opening of 0.10 mm diameter.

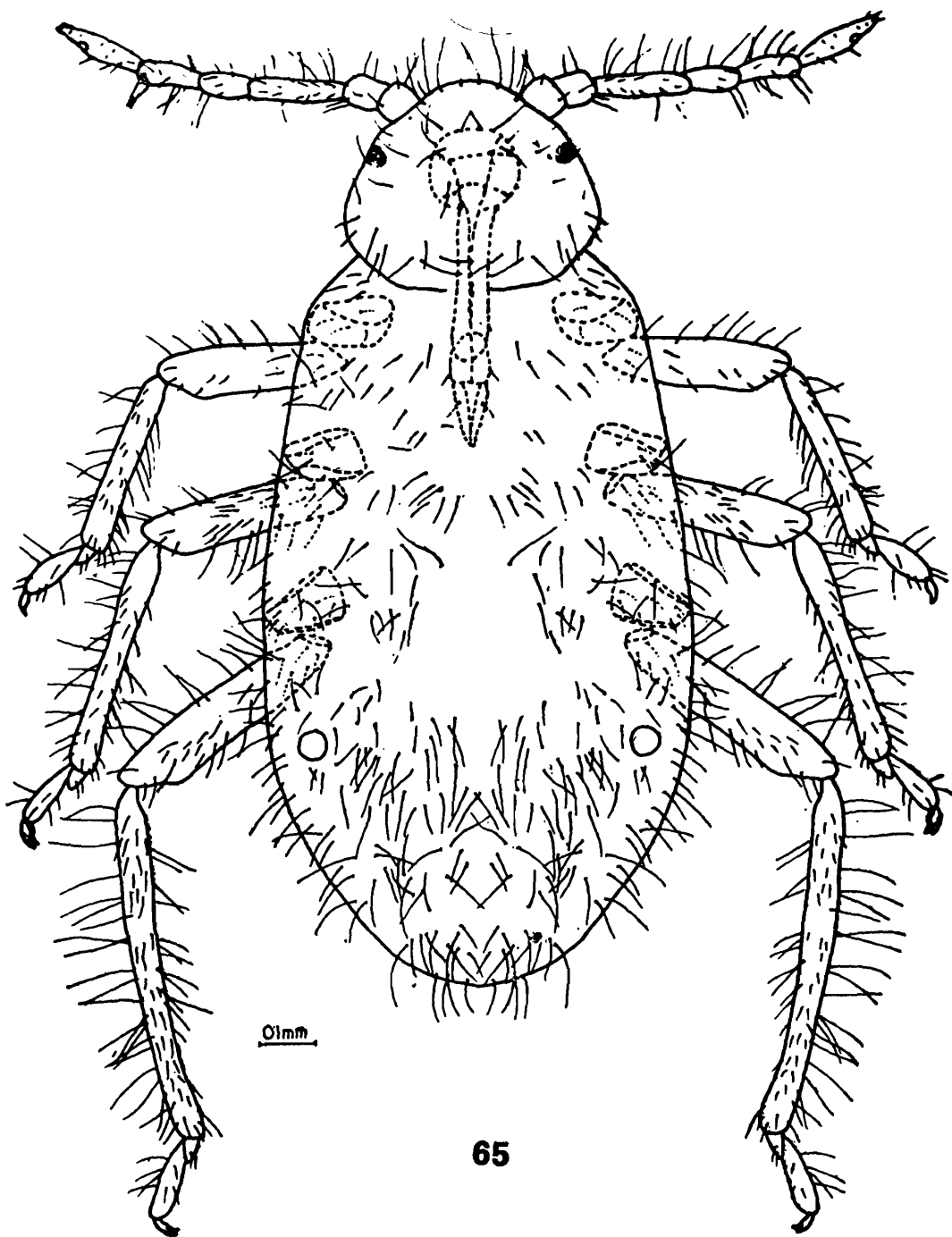
Distribution : India : Himachal Pradesh.

Types : In the private collection of Dr. S. Kanakaraj David, Madras, Tamil Nadu, India.

9. *Aiceona retipennis* David, Narayanan and Rajasingh (Figs. 65-78)

1970. *Aiceona retipennis* David, S., Kanakraj, Naryanan, K., Rajasingh, S. G., *Orient Insects*, 4 (4) : 413.
1973. *Aiceona retipennis*, Ghosh, M. R., and Raychaudhuri, D. N., *Orient Insects*, 7 (4) : 552.

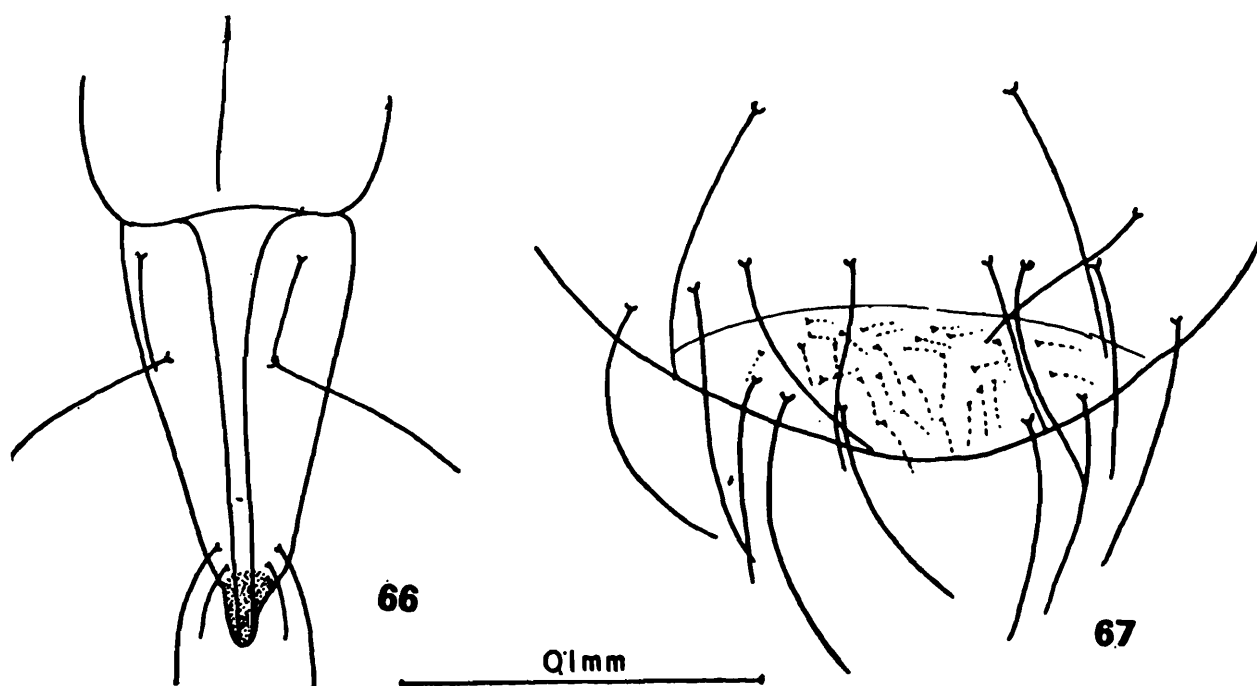
1976. *Aiceona retipennis*, Eastop, V. F. and Hille Ris Lambers, D., Survey of the World's Aphids.
1977. *Aiceona retipennis*, Pal, P. K. and Raychaudhuri, D. N., *Orient Insects*, 11 (3) : 376.



Aiceona retipennis David, Narayanan Rajsingh. Apterous viviparous female : 65, whole body.

1980. *Aiceona retipennis*, Basu, R. C. and Raychaudhuri, D. N., *Rec. zool. Surv. India Misc. Publ.*, 18 : 5.
1980. *Aiceona retipennis*, Raychaudhuri, D. N., Pal, P. K., Ghosh, A. K., *In Aphids of North East India and Bhutan*, 44.

Apterous viviparous female : Body 2.5—2.7 mm long with 1.2—1.5 mm as maximum width. Head light brown, with a median suture ; dorsal cephalic hairs fine, upto 0.16 mm long. Antennae 6-segmented, brown except processus terminalis which is darker, $0.41—0.53\times$ as long as the body ; hairs on the flagellum fine, upto 0.130 mm long and $3.0\times$ as long as the basal diameter of antennal segment III ; secondary rhinaria absent ; processus terminalis $0.40—0.41\times$ as long as base of segment VI. Eyes of 3 facets. Rostrum reaches hind coxae, ultimate rostral segment $0.54—0.60\times$ as long as second segment of hind tarsus and bears 4 accessory hairs, upto 0.7—0.8 mm long. Abdominal dorsum pale, membranous ; hairs on the dorsum of abdomen upto 0.15—0.17 mm long, $3.8—4.0\times$ as long as the basal diameter of antennal segment III ; 8th tergite with 6 hairs, upto $3.5\times$ as long as the mentioned diameter. Siphunculi on brownish cones, surrounded by many hairs, 0.08 mm long. Cauda semicircular, pale brown with 6-7 hairs. Legs yellowish brown ; hairs on femora and tibiae fine, flagellate, longest one on



Alate viviparous ; 66, ultimate rostral segment ; 67, caudal region.

hind tibiae 0.112—0.113 mm long, $2.4\text{--}3.2\times$ as long as the diameter at the middle of the tibia ; first tarsal segments with 8-9 hairs.

Colour : Pale in colour.

Measurements in mm :

	Length	Width	Antennae	Antennal segments				urs	ht ₂
				III	IV	V	VI		
1.	2.7	1.4	1.4	0.47	0.27	0.27	(0.15+0.06)	0.13	0.22
2.	2.5	1.2	1.1	0.43	0.19	0.21	(0.13+0.05)	0.11	0.19

(1, 2, ex indet. Lauraceae, Green-Forest, Simla, 30.v.1969, ZSI).

Alate viviparous female : Body 2.3—2.7 mm long with 1.10 mm as maximum width. Head dark brown ; dorsal cephalic hairs 0.08—0.17 mm long, $2.0\text{--}4.1\times$ as long as basal diameter of antennal segment III ; median suture faint. Antennae brown, 6-segmented, about $0.50\times$ as long as the body ; flagellum with numerous fine hairs, upto 0.06—0.11 mm long, $1.5\text{--}2.8\times$ as long as the basal diameter of antennal segment III ; segment III with 27—37, IV with 9—13 and V with 3—6, circular protruding secondary rhinaria ; processus terminalis $0.31\text{--}0.38\times$ as long as base of antennal segment VI. Rostrum reaches between mid-and hind-coxae, ultimate rostral segment $0.65\text{--}0.66\times$ as long as second segment of hind tarsus and bears 6 accessory hairs, 0.02—0.07 mm long. Abdominal dorsum with transverse spinal sclerotic bands on 1st-3rd tergites and broken sclerotic areas on 4th and 5th tergites, besides small, irregular dark brown 'muskelpalten' like structures along length of inter-segmental sutures ; hairs on the dorsum of abdomen numerous, fine (on anterior tergites 0.07—0.130 mm long and on posterior tergites 0.17—0.18 mm long, these being $2.0\text{--}3.2\times$ and $4.0\text{--}4.1\times$ as long as basal diameter of antennal segment III respectively). Siphunculi on brown cones, densely pubescent with a broad opening 0.07 mm wide. Cauda pale brown, with 6 hairs. Legs brown to dark brown, with numerous fine hairs, first tarsal segments with 8-9 hairs. Wings with polygonal to circular scale-like cells ; radial

sector curved, pale on anterior portion ; cubitals arise separately ; hind wings with both obliques.

Colour : Not recorded.

Measurements in mm :

	Length	Width	Antennae	Antennal segments				urs	ht ₂
				III	IV	V	VI		
1.	2.7	1.3	1.6	0.58	0.28	0.28	(0.18+0.07)	0.13	0.21
2.	2.3	1.2	1.4	0.47	0.25	0.23	(0.16+0.07)	0.14	0.22

(1, 2, ex Indet. Lauraceae, Gleen Forest, Simla, 30.v.1969, ZSI).

Alate male : Body 2.4 mm long with 0.76 mm as maximum width. Head dark brown ; dorsal cephalic hairs numerous, fine, upto 0.163 mm long, $5.0\times$ as long as the basal diameter of antennal segment III. Antennae pale, 6-segmented, $0.61\times$ as long as the body ; hairs on flagellum fine, numerous 0.040—0.106 mm long, longest one on segment III upto $3.8\times$ as long as the basal diameter of the segment; only segment III with 20—23 secondary rhinaria ; processus terminalis $0.29\times$ ($0.32\times$) as long as base of segment VI. Ultimate rostral segment $0.61\times$ as long as second segment of hind tarsus. Abdominal dorsum pale, hairs on dorsum of abdomen fine, longest one on 8th tergite upto $3.7\times$ as long as basal diameter of antennal segment III. Siphunculi pale. Legs pale with many hairs : first tarsal segments with 9, 9, 9 hairs. Wings reticulated.

Colour : Not recorded in life.

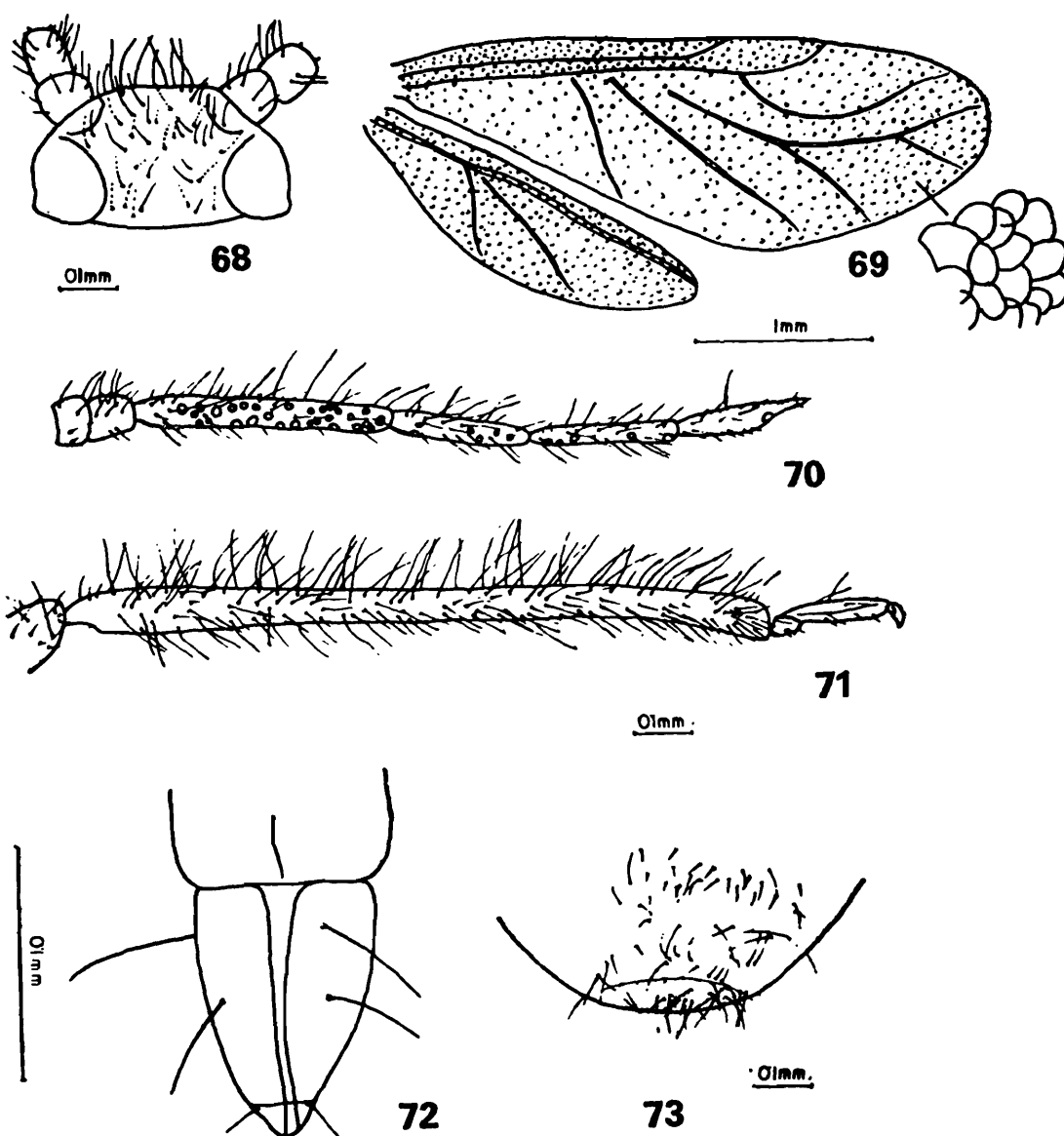
Measurements in mm :

	Length	Width	Antenna	Antennal segments				urs	ht ₂
				III	IV	V	VI		
1.	2.36	0.76	1.26	0.46	0.28	0.27	(0.17+0.08)	0.11	0.18

(ex Yellow Pan Trap,-II, 1970, Kalimpong, W.B., C.U.).

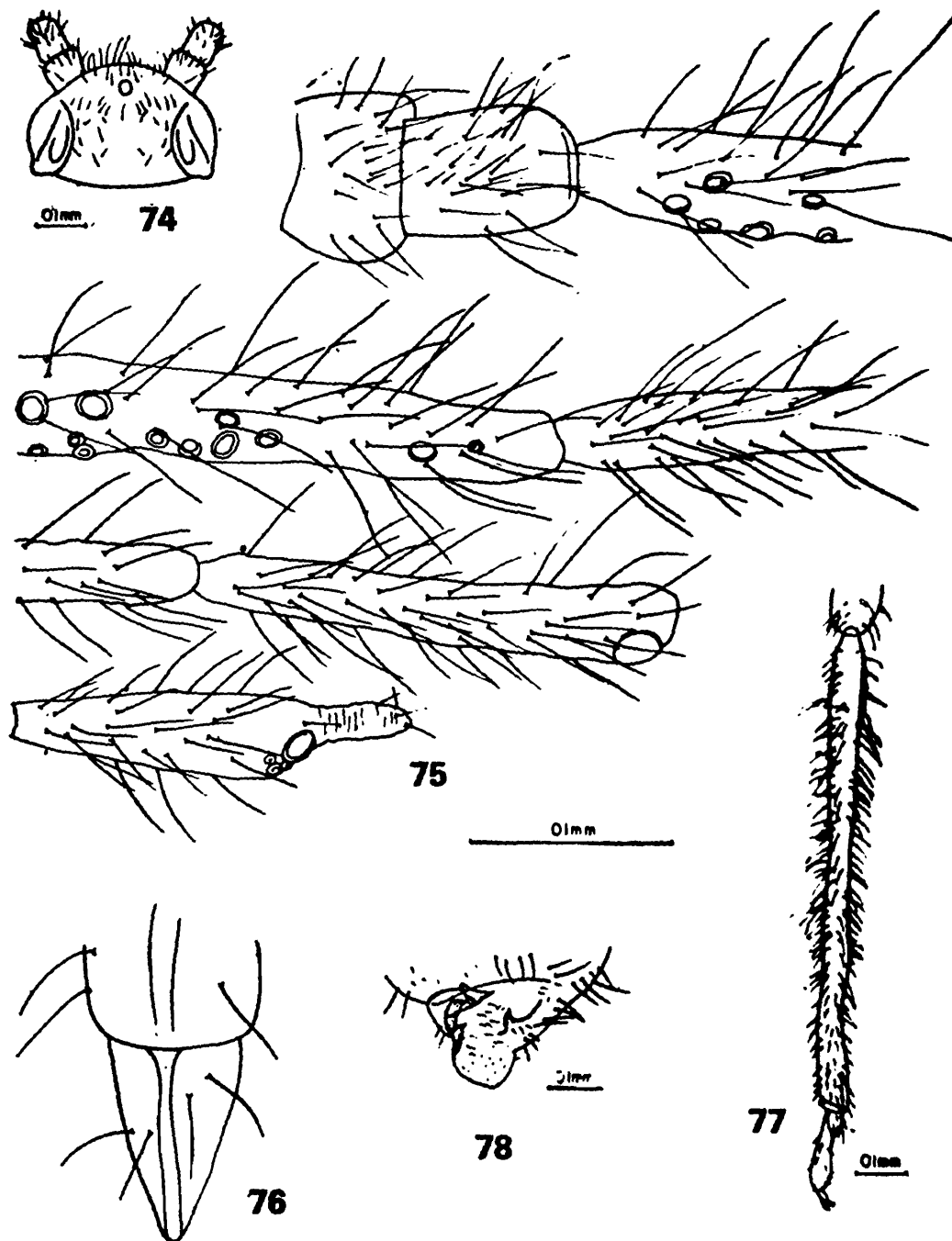
Material examined : Many apterous and alate viviparous females from unidentified tree of Lauraceae, Gleen Forest, Simla, Himachal Pradesh, India, 30.v.1969 (ZSI Colls.) ; Kalimpong, West Bengal, India, 15.xii.1970 ; Mahanadi, Darjeeling District, West Bengal, India, 14.i.1971 ; Toklai, Assam, India, 17.v.1971 ; Paksing, Arunachal Pradesh, India, 30.xi.1971 (C.U. colls.) ; one alate male. Yellow Pan Trap, Kalimpong, West Bengal, India.

Discussion : This is the only species of *Aiceona* known from both Northwestern and Northeastern region of India. Originally



Alate viviparous female : 68, head, 69, wings ; 70, antenna ; 71, part of hind leg ; 72, ultimate rostral segment ; 73, caudal region.

described from alatae collected from an unidentified tree in Nainital, Uttar Pradesh, the species has since been recorded from many unidentified plants of Lauraceae, besides once each from *Buddelia asiatica* (Logganiaceae) and *Falia lanceolata* (Steruliaceae), and both of these collections seem to be chance occurrence ; the period of



Alate male ; 74, head ; 75, antenna ; 76, ultimate rostral segment ; 77, part of hind leg ; 78, male genitalia.

infestation, as evidenced from collections records, appears to extend between the months of November and May ; a few collections have also been made during the months of July and September in the hills of West Bengal.

Distribution : India : Arunachal Pradesh, Assam, West Bengal, Uttar Pradesh, Himachal Pradesh.

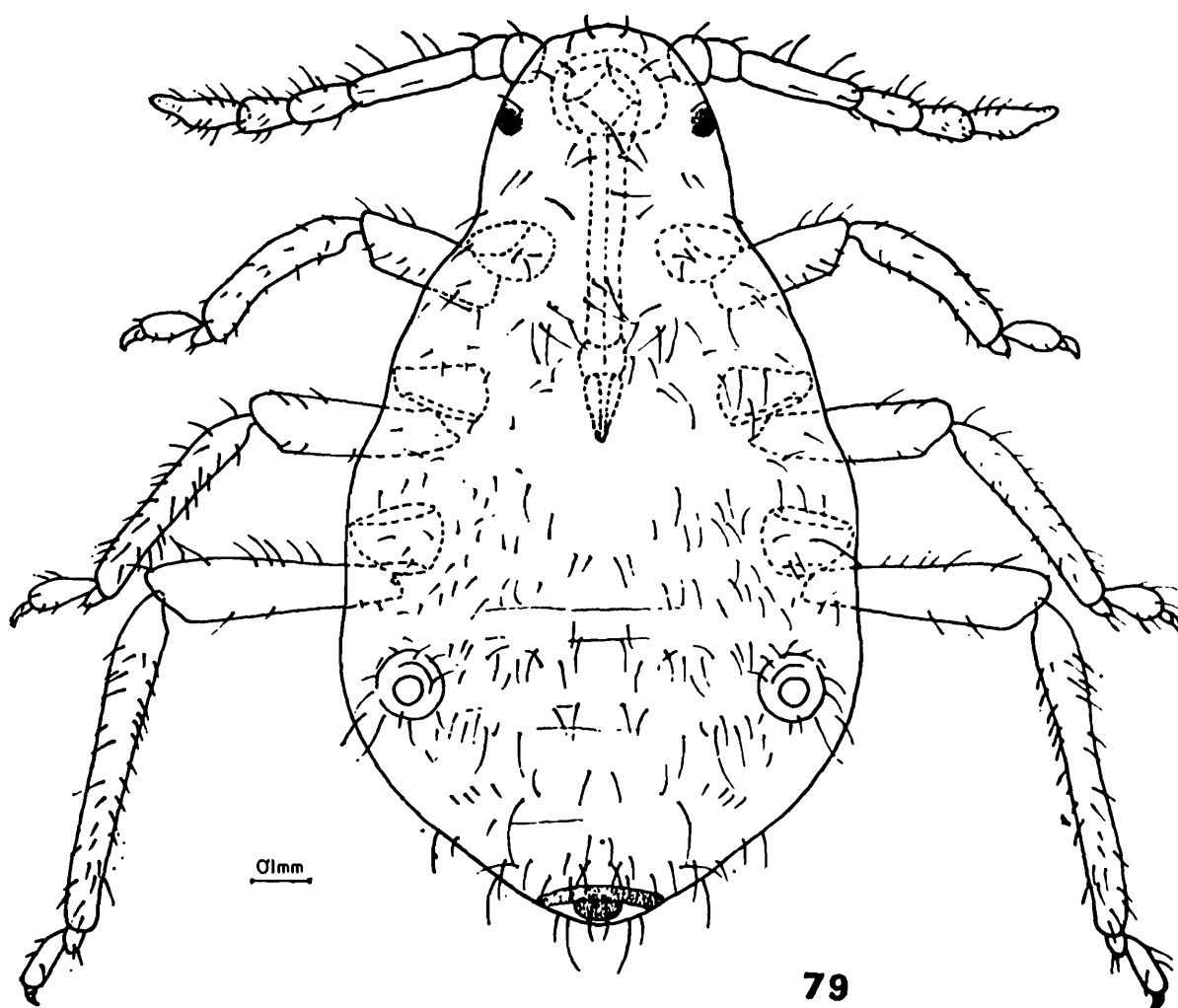
Types : In the private collections of S. Kanakaraja David, Madras, Tamil Nadu, India and one paratype in the collection of D. Hille Ris Lambers, Bennekom, The Netherlands.

10. *Aiceona robustiseta* Ghosh & Raychaudhuri
(Figs. 79-86)

1973. *Aiceona robustiseta* Ghosh, M R. and Raychaudhuri, D. N., *Orient. Insects*, 7 (4) : 553.
1976. *Aiceona robustiseta*, Eastop, V. F. and Hille Ris Lambers, D., *Survey of the World's Aphids*, 19.
1977. *Aiceona robustiseta*, Pal, P K. and Raychaudhuri, D. N., *Orient. Insects*, 11 (3) : 377.
1980. *Aiceona robustiseta*, Basu, R. C. and Raychaudhuri, D. N., *Rec. zool. Surv. India Misc. Publ.*, 18 :3.
1980. *Aiceona robustiseta*, Raychaudhuri, D. N., Pal, P. K., Ghosh, A. K. *In Aphids of North East India and Bhutan*, 44.

Apterous viviparous female : Body 1.9—2.4 mm long with 1.1—1.3 mm as maximum width. Head with a median suture; dorsal cephalic hairs numerous, a pair being long and stout, others much thinner and shorter, longest one upto 0.130 mm long, $2.9-4.1\times$ as long as basal diameter of antennal segment III. Antennae 6-segmented, dusky to brown, $0.39-0.46\times$ as long as the body ; flagellum with spinular imbrication, becoming more distinct apicad ; hairs on the flagellum fine, 0.05—0.115 mm long, longest one on segment III, 0.115 mm long, upto $2.3\times$ as long as the basal diameter of the segment III ; accessory rhinaria on segment VI placed close to the primary rhinarium ; processus terminalis $0.58-0.75\times$ as long as base of antennal segment VI ; base of segment VI with

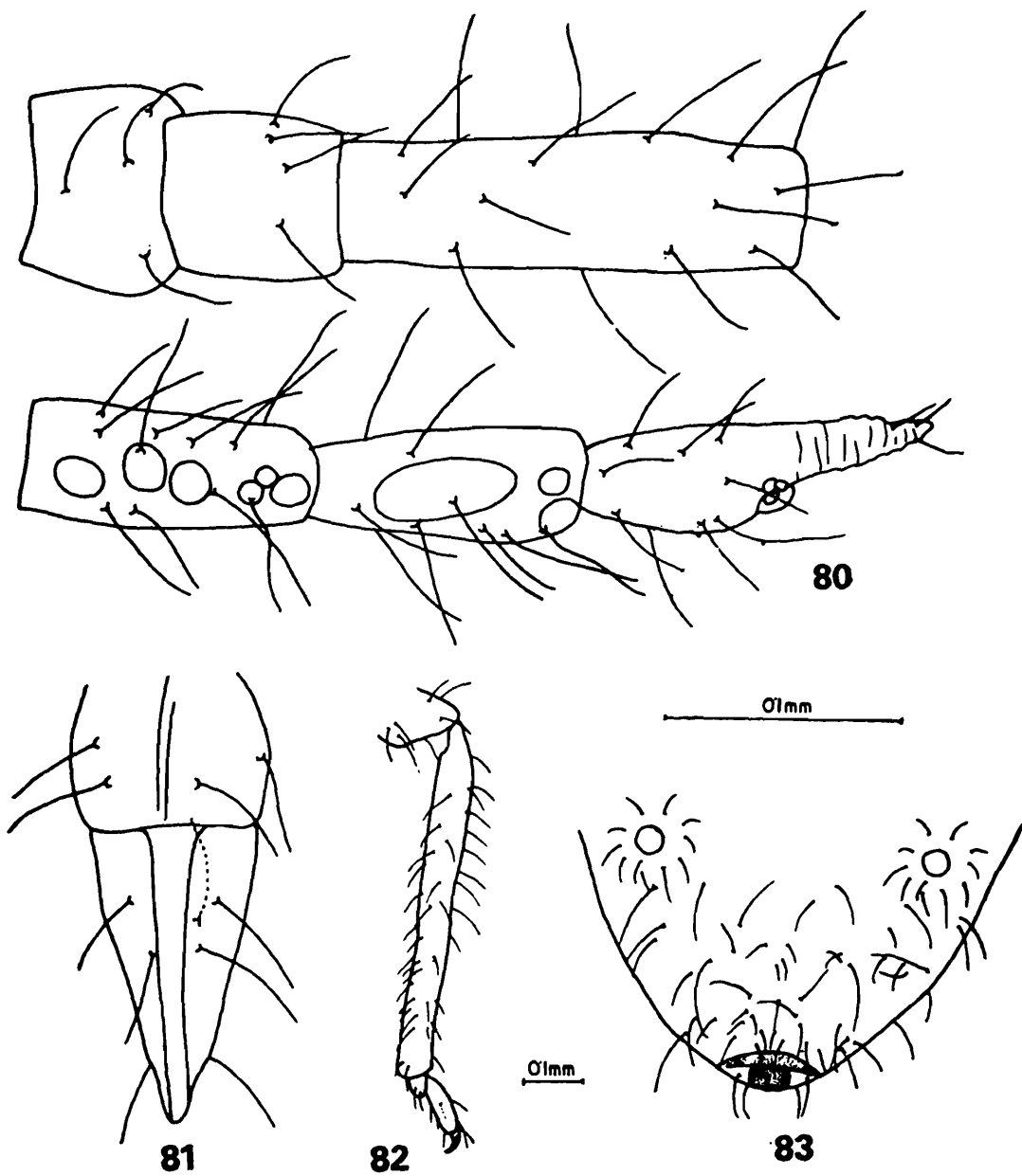
11—13 fine hairs. Rostrum reaches hind coxae, ultimate rostral segment $0.85\text{--}0.92\times$ as long as second segment of hind tarsus and bears 3—5 accessory hairs. Abdominal dorsum pale, densely pubescent, hairs on the dorsum of abdomen long, stout with acute apices, mixed with shorter and thinner hairs, longest hair on anterior tergite $0.146\text{--}0.215\text{ mm}$ long, $3.2\text{--}4.8\times$ as long as the basal diameter of antennal segment III ; 7th tergite with 6th and 8th tergite with 8 long, stout hairs, upto $0.178\text{--}0.215\text{ mm}$ long, $3.7\text{--}4.3\times$ ($4.2\text{--}5.6\times$) long as the mentioned diameter. Siphunculi on pale cones, surrounded by 10—11 hairs and with pore 0.05 mm wide. Cauda dusky, with 10 hairs including a pair of thicker, longer hairs. Legs with femora and tibiae dusky bearing many fine hair $0.050\text{--}0.106$



Aiceona robustiseta Ghosh & Raychaudhuri, Apterous viviparous female :
79, whole body.

mm long, longest one on hind tibiae 0.106 mm long, $1.6\times$ as long as the diameter at the middle of the tibia ; first segments with 5—6 hairs including a short, thick, sense peg.

Colour : Creamy yellow in life.



Apterous viviparous female : 80, antenna ; 81, ultimate rostral segment ; 82, part of hind leg ; 83, posterior portion of abdomen.

Measurements in mm :

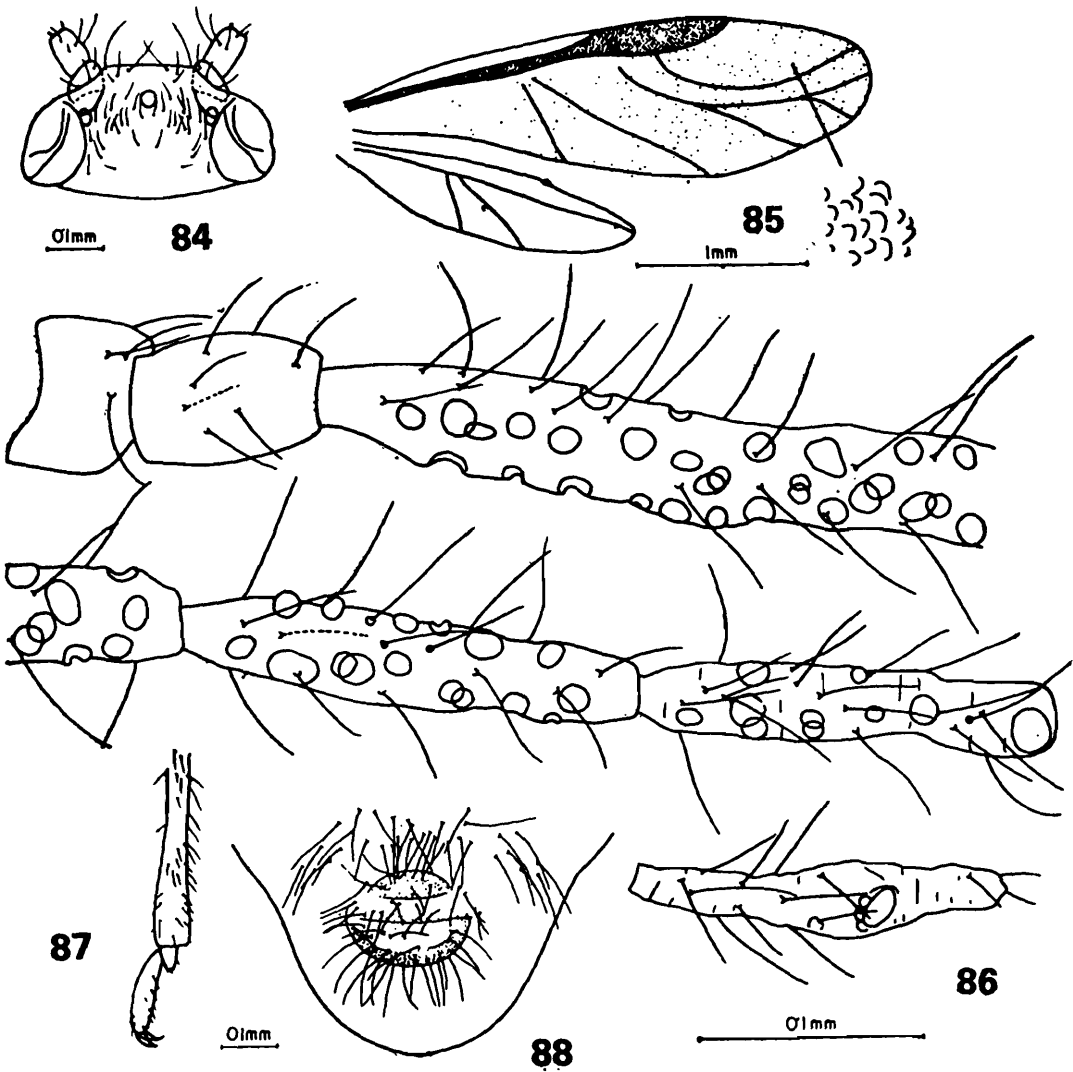
	Length	Width	Antenna		
1.	2.17	1.15	0.94		
2.	2.22	1.21	1.10		
3.	2.03	1.10	0.99		
	Antennal segments			urs	ht ₂
III	IV	V	VI		
0.34	0.13	0.12	(0.115+0.067)	0.13	0.15
0.38	0.15	0.13	(0.117+0.08)	0.14	0.16
0.34	0.15	0.14	(0.118+0.07)	0.13	0.15

(1 ex *Litsaea polyantha*, Kalimpong, West Bengal, 13.iv.1971, C.U. ; 2, 3 ex. indet host, Shangpung, Jaintia Hills, Meghalaya, 6.xii.1975, Z.S.I.).

Alate viviparous female : Body 2.2-2.4 mm long with 0.81-0.98 mm as maximum width. Head smooth, brownish ; dorsal cephalic hairs fine, upto 4.0-4.7×as long as the basal diameter of antennal segment III. Antennae 6-segmented, pale to pale-brown, 0.52-0.58× as long as the body; flagellum imbricated ; hairs on the flagellum upto 0.100 mm long, upto 0.300×as long as the basal diameter of antennal segment III ; segment III with 32-38, IV with 8-11, V with 2-7 protuberant secondary rhinaria ; processus terminalis 0.43-0.55×as long as base of antennal segment VI. Rostrum reaches hind coxae, ultimate rostral segment nearly equal to second segment of hind tarsus and bears 6 accessory hairs. Abdominal dorsum pale, bearing pale-brown, segmental, transverse sclerotic bands on 1st-7th tergites, the band on 5th tergite being broadest, besides paired marginal sclerotic patches on 1st-6th tergites hairs on the dorsum of abdomen mostly arising from spinal and marginal sclerotic areas, longest one on anterior tergites 0.155-0.198 mm long, 4.7-5.7×as long as the basal diameter of antennal segment III ; 7th tergite with 4th and 8th tergite with 5 hairs, those being 0.181-0.231 and 0.221-0.247 mm long, upto 5.5-7.3×and 6.7-7.5 as long as the mentioned diameter respectively. Siphunculi on pale-brown cones, surrounded by many long and short hairs. Cauda with 9-10

hairs. Legs paler than head ; longest hair on hind tibiae $2.2\times$ as long as the diameter at the middle of the tibia. Wings pale; venation normal ; forewings with inner margin of subcosta and pterostigma bearing long fine hairs.

Colour : Creamy yellow with dark head and abdomen.



Alate viviparous female : 84, head ; 85, wings ; 86, antenna ; 87, part of hind leg ; 88, caudal region.

Measurements in mm :

	Length	Width	Antenna
1.	2.21	0.81	1.13
2.	2.27	0.97	1.17

III	Antennal segments			urs	ht ₂
	IV	V	VI		
0.49	0.19	0.18	(0.11+0.06)	0.14	0.15
0.51	0.19	0.19	(0.11+0.07)	0.15	0.16

(1, 2, ex *Litsaea polyantha*, Kalimpong, West Bengal, 13.x.1971, C.U.).

Alate viviparous female : Body 2.2-2.6 mm long with 0.72-0.89 mm as maximum width. Head brown, pubescent, longest hair upto 5.0× as long as the basal diameter of antennal segment I. Antennae 6-segmented, pale brown, 0.45-0.65 as long as the body ; hairs on the flagellum fine, 0.05-0.08 mm long, upto 3.4× as long as the basal diameter of antennal segment III ; segment III with 34-36, IV with 17 and V with 9 secondary rhinaria ; processus terminalis 0.41-0.43× as long as base of antennal segment VI. Rostrum reaches hind-coxae, ultimate rostral segment 1.0-1.12× as long as second segment of hind-tarsus. Abdominal dorsum pale bearing, broad, segmental, spinal bands on 1st-6th tergites ; hairs on the dorsum of abdomen fine, flagellate, arranged in segmental, transverse rows besides on marginal sclerotic areas and arising from distinct bases, upto 0.198-0.215 mm long. Siphunculi on brown cones, surrounded by 27-30 hairs. Legs pale brown without any pseudosensoria on hind-tibiae. Subgenital plate with 12 short, stout hairs arranged in two groups. Forewings without hairs.

Colour : Not recorded.

Measurements in mm :

	Length	Width	Antenna		
1.	2.62	0.89	1.17		
III	Antennal segments			urs	ht ₂
	IV	V	VI		
0.41	0.20	0.19	(0.14+0.06)	0.18	0.16

(ex Yellow Pan Trap, Kalimpong, West Bengal,—II, 1970, C.U.).

Material examined : Apterous viviparous females from *Litsaea polyantha*, Kalimpong, West Bengal, 13.iv.1971 ; two alate viviparous females from *Litsaea polyantha*, Kalimpong, West Bengal, 13.x.1971 (C.U. Colls.) ; 10 apterous viviparous females from indet host, Shangpung, Jaintia Hills, Meghalaya, 6.xii.1975 (ZSI Coll) ; one alate oviparous female from yellow pan trap, Kalimpong, West Bengal, Feb., 1970 (C.U. Colls.).

Discussion : The species was first described from *Litsaea polyantha* on collections of apterae and alate viviparae during April and October from Darjeeling district in West Bengal. These insects are reported to form moderate-sized colonies on the shoots of host-plants and are attended by ants. Alate oviparae have subsequently been collected from the same locality during February and June and the species appears to be holocyclic, monoecious on plants of Lauraceae. The species may be separated from other pale-bodied *Aiceona* by following the key.

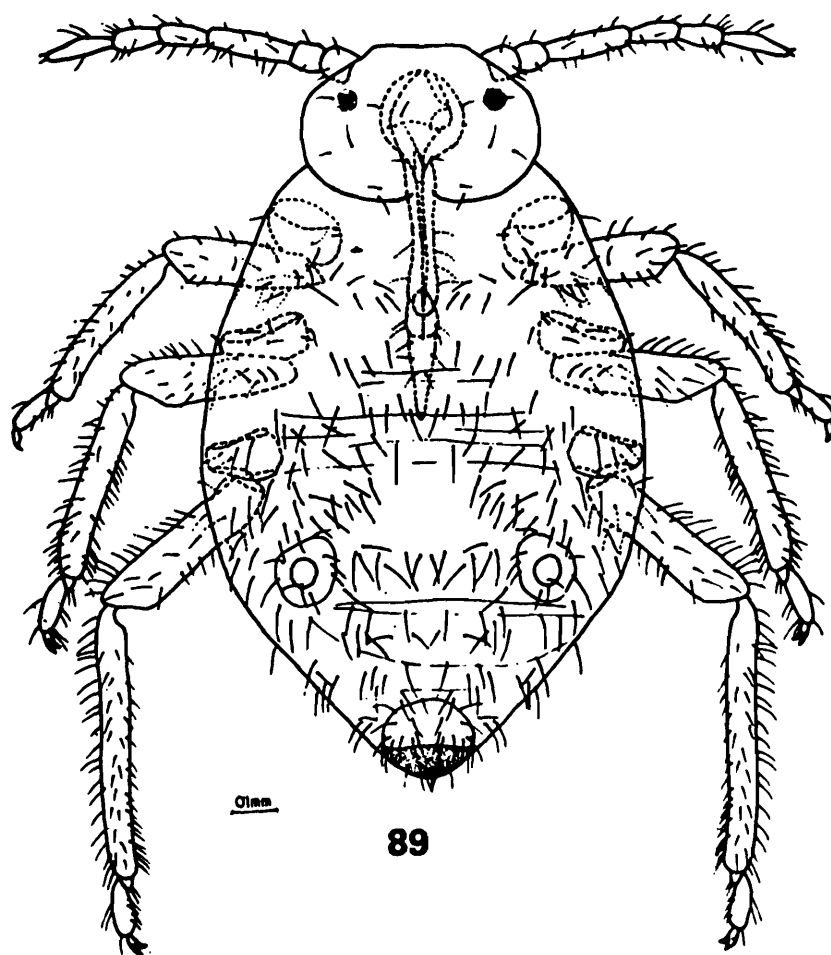
Distribution : INDIA : West Bengal ; Meghalaya.

Types : In the collection of Entomology Laboratory, Department of Zoology, University of Calcutta, India.

11. *Aiceona titabarenis* (Raychaudhuri and Ghosh) (Fig. 89-97)

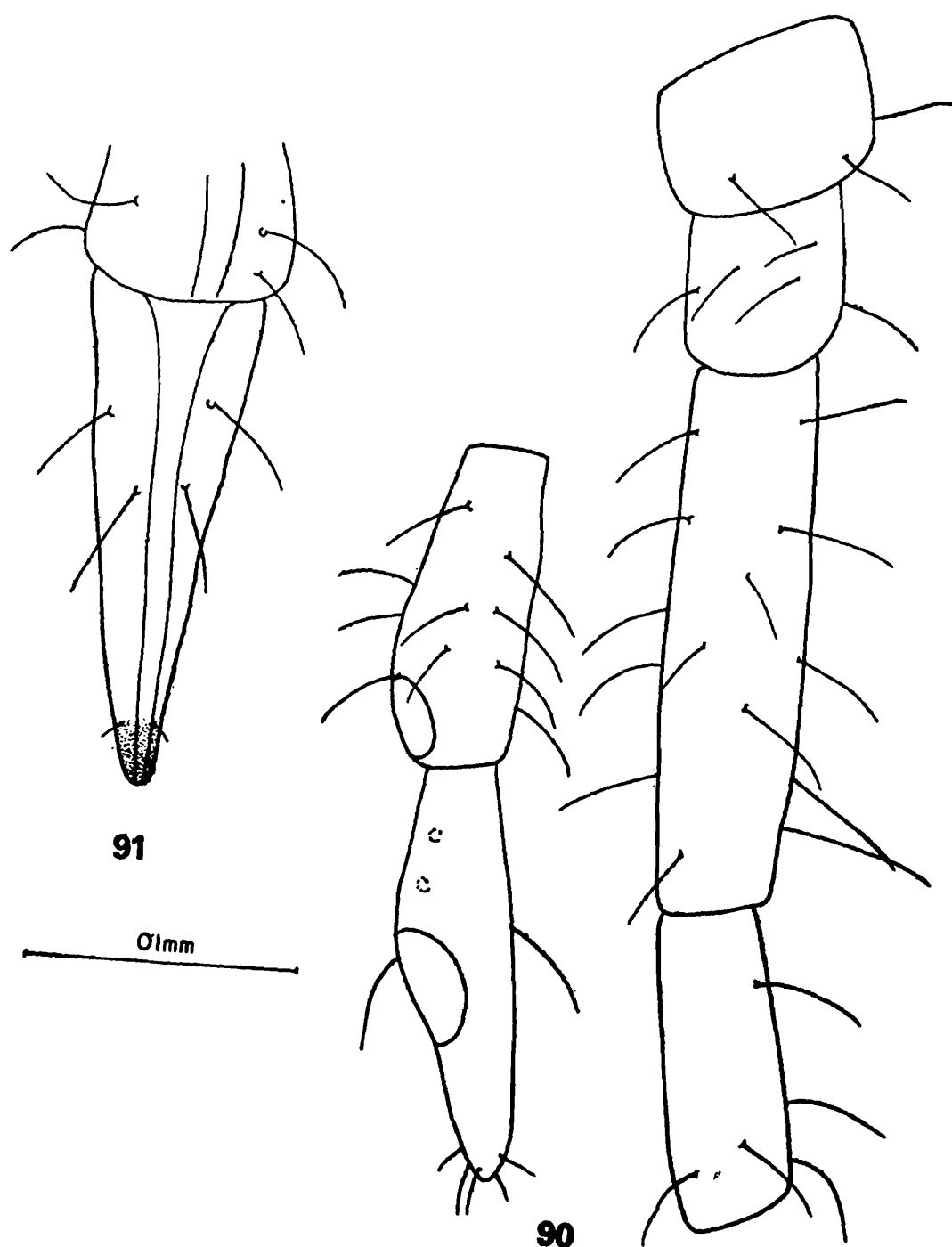
1964. *Lachnus titabarensis* Raychaudhuri, D. N., and Ghosh, A. K., *Zool. meded. Leiden.*, **39** :257.
1968. *Aiceona litseae* Basu, A. N. and Hille Ris Lambers, D., *Ent. Ber. Amst.*, **28** : 7.
1973. *Aiceona litseae*, Ghosh, M. R. and Raychaudhuri, D. N., *Orient. Insects*, **7** (4) : 549.
1976. *Aiceona titabarensis*, Eastop, V. F. and Hille Ris Lambers, D., *Survey of World's Aphids*.
1980. *Maculolachnus titabarensis*, Raychaudhuri, D. N., Ghosh, M. R. and Ghosh, A. K., *In Aphids of North-East India and Bhutan*, 400.
1980. *Aiceona litseae* Basu, R. C. and Raychaudhuri, D. N., *Rec. Zool. Surv. India Misc. Publ.*, **18** : 4.

Apterous viviparous female : Body 2.2-2.7 mm long with 1.2-1.5 mm as maximum width. Head brown to dark brown, with a median suture ; dorsal cephalic hairs fine with acute apices, upto 0.100 mm long, $2.5\times$ as long as the basal diameter of antennal segment III. Antennae 6-segmented (occasionally 5-segmented), lighter than head, $0.43-0.58\times$ as long as the body ; flagellum smooth on base of segment III, rest gradually more distinctly imbricated apicad ; hairs on the flagellum thick, acute at apices, 0.07-0.09 mm long, upto 2.0-2.3 ($3.5\times$) as long as the basal diameter of antennal segment III. Rostrum reaches hind-coxae, ultimate rostral segment slender $1.0-1.2\times$ as long as the second segment of hind tarsus bearing 6-8 long fine accessory hairs, besides preapicals, thoracic tergum brownish, sclerotic on prothorax ; meso and matanota with small marginal sclerites. Abdominal dorsum brownish, membranous, often with a row of small brown pleural patches on either side ;



Aiceona titabarensis (Ghosh & Raychaudhuri). Apterous viviparous female : 89, whole body.

hairs on the dorsum of abdomen long, thick with acute apices, arising mostly from small, circular brownish scleroites, (sometimes a fine hair with furated apices) ; dorsal hairs 0.130-0.230 mm long and $3.3-5.9\times$ as long as the basal diameter of antennal segment III; 7th tergite with 12-22 hair and 8th tergite with 8-12 hairs, of similar nature and upto $3.3-6.0\times$ as long as the mentioned diameter.



Apterous viviparous female : 90, antenna ; 91, ultimate rostral segment.

Siphunculi on brown cones, surrounded by 25-40 hair and with part of 0.06-0.08 mm diameter. Cauda semicircular, brown, with 12-14 hairs, which are distinctly shorter than dorsal abdominal hairs. Legs dark brown with tibiae and tarsi darker, bearing numerous hairs, longest one on hind tibiae 0.100 mm long, $1.5\times$ as long as the diameter at the middle of the tibia ; first tarsal segments with 6, 6, 6 hairs (sometimes individual tarsi with 5-8 hairs ; Basu and H.R.L., 1968).

Colour : Brown to dirty brown in life.

Measurements in mm :

	Length	Width	Antenna		
1.	2.6	1.5	1.20		
2.	2.6	1.5	1.30		
3.	2.2	1.2	1.05		
4.	2.3	1.4	1.02		
	Antennal segments			urs	ht ₂
III	IV	V	VI		
0.36	0.19	0.19	(0.16+0.06)	0.20	0.20
0.42	0.24	0.24	(0.19+0.05)	0.20	0.20
0.37	0.15	0.17	(0.14+0.05)	0.20	0.19
0.51	0.20	0.21	(0.13+0.07)	0.20	0.19

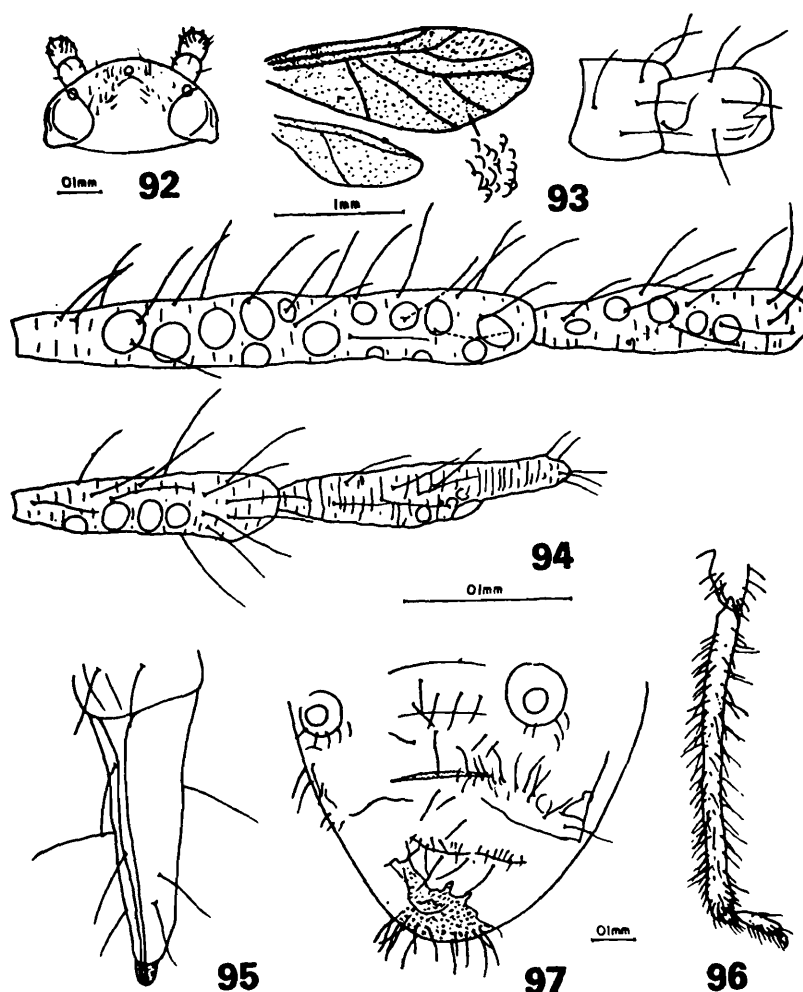
(1, ex *Heteropnax fragrans*, Titabar, Assam,—i.1960, C.U.

2, 4 ex *Litsaea polyantha*, Mongpoo, West Bengal, 20.iv.1970, C.U. ;

3 ex *Litsaea polyantha*, Kalimpong, West Bengal, 19.ix.1965, ANB).

Alate viviparous female : Body 2.0-2.5 mm long with 0.95-1.1 mm a maximum width. Head dark brown with long fine dorsal hairs. Antennae 6-segmented, brown to dark brown with bases of III-IV paler, $0.46-0.50\times$ as long as body ; hairs on the flagellum upto 0.07 mm long, $2.3-4.0\times$ as long as the basal diameter of antennal segment III ; segment III with 20-27 secondary rhinaria, irregularly arranged over entire length, IV with 7-14 and V with 1-8

similar rhinaria. Abdominal dorsum pale, bearing irregular, brownish, transverse segmental spinal sclerites on 1st-8th tergites besides some pale, poorly developed marginal sclerites on 1st and 2nd tergites ; hairs on the dorsum of abdomen fine, upto 0.124-0.130 mm long, $3.8-4.0\times$ as long as the basal diameter of antennal segment III ; 7th tergite with 11-17 hairs and 8th tergite with 7-12 hairs. Siphunculi on brown cones. Cauda brownish bearing 10-14 hair. Forewings diffused brown in colour except coastal margin and subcosta which are darker ; media twice-branched and subcosta with a row of long, fine hairs ; hind wings with both obliques. Legs dark bearing many long fine hair, longest one on hind tibiae about $3.0\times$ as long as the width at the middle of the tibia ; first tarsal segments with 5-9 hairs.



Alate viviparous female : 92, head, 93, wings ; 94, antenna ; 95, ultimate rostral segment ; 96, part of hind leg ; 97, posterior portion of abdomen.

Colour : Head and thorax dark brown, abdomen dirty grey, in life.

Measurements in mm :

Length		Width		Antennae	
1.	2.07	0.95		1.2	
2.	2.40	1.10		1.2	
Antennal segments					
III	IV	V	VI	urs	ht ₂
0.44	9.24	0.20	(0.13+0.05	0.24	0.16
0.42	0.22	0.21	(0.15+0.05)	0.23	0.15

(1, ex *Litsaea polyantha*, Kalimpong, W.B.,—vii-1969, C.U. ;
2, ex *Litsaea polyantha*, Soreang, Darjeeling Dist., W.B. 29.v. 1957, ANB).

Alate viviparous female : Body 2.0-2.4 mm long with 0.76-1.06 mm as maximum width. Head brown, smooth ; dorsal cephalic hairs fine, long and acute at apices. Antennae 6-segmented, brown, 0.49-0.54 × as long as the body, with bases of segments III-V pale ; flagellum imbricated ; hairs on flagellum fine, 0.050-0.066 mm long, longest one on segment III 2.9-3.1 × as long as the basal diameter of the segment ; segment III, with 17-26, IV with 8-12 and V with 2-6 large, round to oval, secondary rhinaria arranged irregularly over the segments ; one accessory rhinaria on VI placed much based and other shifted on to processus terminalis ; processus terminalis 0.25-0.40 × (0.42 ×) as long as base of antennal segment VI. Rostrum reaches beyond hind coxae, ultimate rostral segment slender, 1.12-1.25 × as long as second segment of hind tarsus and bears 5-6 accessory hairs. Abdominal dorsum pale, feebly wrinkled, bearing segmental sclerotic patches on 1st-8th tergites besides smaller marginal sclerotic patches on 1st-7th tergites ; dorsal hairs on abdomen stout, acute at apices, mostly arising from spinal sclerotic patches and marginal patches, 0.083-0.137 mm long, 3.3-6.0 × as long as the basal diameter of antennal segment III ; 7th tergite with 6 hairs, upto 6.0-8.0 × as long as the basal diameter of antennal segment III

and 8th tergite with 6 hairs, upto $3.7-6.4\times$ as long as the mentioned diameter. Siphunculi on brown cones, bearing many fine hairs. Legs darker than head, femora paler than rest of leg, longest hair on hind tibiae 0.086-0.90 mm long, $1.6-1.8\times$ as long as the diameter at the middle of the tibia ; hind tibiae with some faint pseudocensoria—like structures. Wings as in viviparous female.

Colour : Greyish in life.

Measurements in mm :

	Length	Width	Antenna		
1.	2.2	0.90	1.11		
2.	2.25	0.96	1.18		
	Antennal segments			urs	ht ₂
III	IV	V	VI		
9.42	0.18	0.19	(0.15+0.05)	0.21	0.16
0.42	0.21	0.19	(0.16+0.04)	0.20	0.16

(1, 2 ex *Litsaea polyantha*, Mongbul, W.B., 12.xii.1978, C.U.).

Material examined : Many apterae, alate viviparae and alate oviparae, from *Litsaea polyantha* Kalimpong, Mongbul, Mongpoo, Kurseong, Feshoke, Darjeeling district, West Bengal, India, July 1969 to December 1971, (C.U. Colls.) ; one apterous and one alate viviparous female from *Litsaea polyantha* Kalimpong, West Bengal, 19.xi.1965 and Soreang, West Bengal, India, 29.v.1957, Coll. A. N. Basu ; many apterae from *Heterophnax Iragrans*, Titabar, Assam, India, Jan., 1960, Coll. A. K. Ghosh (C.U. Colls.).

Discussion : The species was originally described from apterous specimens collected on *Heteropanax fragrans* in the plains of Assam, India, under *Lachnus* (Raychaudhuri and A. K. Ghosh, 1964), Basu and Hille Ris Lambers (1968) described both apterous and alate viviparous females as *Anoccia litseae* n. sp. and reported it to be fairly common in the hills of Darjeeling district, infesting undersides of the leaves and tender shoots of *Litsaea polyantha* and leading a viviparous cycle throughout the year. M. R. Ghosh and

Raychaudhuri (1973) described the oviparous morph from collections on *Litsaea polyantha* in Darjeeling district and also reported its occurrence in Sikkim, Raychaudhuri *et al.* (1980) considered the species under *Maculolachnus* without any reference to Eastop and Hille Ris Lambers (1976) wherein *Lachnus titabareneis* Raychaudhuri and A. K. Ghosh, is put under *Aiceona* with *A. litseae* Basu and Hille Ris Lambers, as a synonym. An examination of material of both *titabarensis* and *litseae* justifies the position as suggested by Eastop and Hille Ris Lambers (op. cit). Although Basu and Hille Ris Lambers (1968) mentioned that it is not attended by ant, black ants are reported to attend the species on *litsaea* (M. R. Ghosh and Raychaudhuri, 1973).

The species as such has two hosts and at least on *Litsaea polyantha*, it can produce both viviparous and oviparous morph, thereby suggesting a holocyclic, sutoecious life cycle. The period of incidence of viviparous morphs in Darjeeling-Sikkim region appears to be all through the year but oviparae have only been recorded during December—March.

Distribution : INDIA : Assam, West Bengal, SIKKIM.

Types : Type of *Lachnus titabarensia* is deposited in the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India. Types of *Aiceona litsae* is deposited in the collection of State Agricultural Research, Institute, Govt. of West Bengal, Calcutta, India except some paratypes in the collection of D. Hille Ris Lambers, Bennekom, The Netherlands.

Genus 3. *Anoecia* Koch, 1775

1775. *Anoecia* Koch, C. L., *Die Pflanz. Aphiden.*, 3 : 275 ; Baker, A. C., 1920. *Bull. U. S. Dep. Agric.*, 826 : 13 ; Palmer, Miriam, 1952. *Aphids of Rocky Mountain Region*, 10 ; Zwölfer, H., 1957. *Z. angew. Ent.*, 40 : 204 ; Heie, Olc. H., 1980. *Fauna ent. Scand.*, 9 : 100 ; Raychaudhuri, D. N., Pal, P. K., Ghosh, A. K. *In Aphids of North East India and Bhutan*, 45. Type species : *Aphis corni* Fabricius.
1950. *Neanoecia* Börner, C., *Neue europ. Blattlaus*, 16 ; Zwölfer, H., 1957. *Z. angew. Ent.*, 40 : 201. Type species : *Neanoecia krizusi* Börner.
1950. *Subanoecia* Börner, C., *Mitt. thuring bot. Ges.*, 4 (3) : 180 ; Zwölfer, H., 1957. *Z. angew. Ent.*, 40 : 219. Type species : *Schizoneura vagans* Koch (as subgenus).

Morphology : Head and pronotum fused dorsally, free laterally. Antennae usually 6-segmented, hardly exceeding $0.60 \times$ length of body ; secondary rhinaria oval to nearly circular, present on antennal segments III—V, often also on base of segment VI in alatae and often also in apterae ; processus terminalis $0.11-0.50 \times$ as long as base of last antennal segment. Eyes large bearing ocular tubercles. Rostrum reaches upto hind coxae, ultimate rostral segment $0.70-0.96 \times$ as long as second segment of hind tarsus, always with a number of accessory hairs. Mesothoracic furca with arms united at base. Dorsum may be dark sclerotic or pale or with variably developed sclerotic bands ; dorsal hairs numerous, with acute or spatulate or incrassate apices ; marginal tubercles usually present on abdominal segments 1-7, but may be variably absent on one side or on some segments. Siphunculi present, poriform, placed on hair-bearing cones. Cauda round, broader than long with number of fine hairs. Subanal plate entire. Legs bearing numerous long hairs, usually with acute or flagellate apices ; first tarsal segments with 5-7 hairs ; dorsoapical hairs on second tarsal segments thick, usually blunt at apices. Forewings with large but truncated, dark, pterostigma ; media once branched ; hind wings with both oblique.

Sexuales apterous. Oviparae usually deposit 2 eggs, somewhat smaller in size than viviparous apterae.

Discussion : A total of 21 species have been listed under *Anoecia* s.l., including one under *Paranoecia* Zwölfer (Eastop and Hille Ris Lambers, 1976) ; another species has been added to *Anoecia* s.s. viz. *radiciphaga* from West Bengal (Pal & Raychaudhury, 1977). Most of the species (66%) of *Anoecia* are known from Palaearctic region, some being very widely distributed elsewhere. Börner *et al.* (1957) classified the subgenus *Anoecia* s.s. into two groups viz. Group (A) marginal tubercles absent on abdominal segments 5 & 6 : to this group belong *nemoralis* and *furcata*, both of which have larva with spatulate setae on head, antenna, anterior thoracic segments and legs and Group (B) marginal tubercles present to segments 5 & 6 : under this group belong *corni* (Fab) and *disculigera* Börner (now—*corni*) larvae of which differ in absence or having spatulate setae only on 5th-7th abdominal segments, (e.g. *corni*) or on 3rd-7th and sometimes also is 1st and

2nd (e.g. *disculigera*). Börner *et al.* (1957) put *vagans* under subgenus *subanoecia* Börner, differentiating the latter from subgenus *Anoecia* by the absence of black disc on abdomen of alates and presence of only one fundatrigeniae generation on *Cornus* (as against presence of disc and 2 generations on *Cornus*). Börner (1950) described one allied-genus, *Neanoecia* and a subgenus *Subanoecia* which were retained by Zwölfer (1957) but are now being considered as complete synonyms of *Anoecia*; Zwölfer (1957) described another allied genus *Paranoecia* which is known by only one European species and is distinguished by very short processous terminalis ($0.10\times$ as long as base) as against much longer processus terminalis ($0.20\times$ to $0.50\times$) in *Anoecia*; Eastop and Hille Ris Lambers (1976) and Heie (1980) treated *Paranoecia* as a subgenus of *Anoecia*. Zwölfer (1957) on the basis of biology of European species, provided a schematic plan showing phylogeny of Anoeciinae; in this scheme holocyclic monoeocious group, *Paranoecia* has been shown as one branch from main stream of evolution while the other branch leads to holocyclic heteroecious and anholocyclic species of *Anoecia* s.l.

Palmer (1952) has dealt with North American species of the genus. Zwölfer (1957) has provided an extensive key, detailed description and biology of the species known from Central Europe. Heie (1980) has provided keys (to the apterae on primary host, on herbaceous hosts and also to alatae), diagnostic characters, distribution and biology of 6 species from Scandinavia. A key to the total of six species, including the endemic ones recorded from India has been provided by Chakraborty *et al.* (1982).

Biology : Zwölfer (1957) has dealt with biology of seven species of *Anoecia* from Europe; some species may be holocyclic, monoeocious on *Carex* and *Eriophorum*, or on *Agropyrium* or *Agrostis*, *Festusa* etc. (e.g. *pskovica* Mordv., *krizusi* Börner, *zirnitzi* Mordv.) or holocyclic and heteroecious, alternating between *Cornus* and number of grasses e.g. *Agrostis*, *Bromus*, *Cynosurus*, *Dactylus*, *Holcus*, *Hordeum*, *Panicum*, *Pharalis*, *Poa* and *Triticum* etc. (e.g. *corni* Fab., group, *vagans* Koch); some species, e.g. *A. major* Börner, *A. nemoralis* Börner are largely known from grass roots but here again *Cornus sanguinea* is believed to be the primary host (Heie, 1980). In case of host alternating species, 2-3 generations of

fundatrigeniae may develop on *Cornus* in spring (e.g. *corni*, *major*) but in some cases, only one generation (e.g. *vagans*) is produced on *Cornus*. Alate fundatrigeniae produce young on grass roots and a number of generations of apterous and alate viviparae develop in summer ; in autumn, all nymphs develop into alate sexuparae who fly back to *Cornus* and produce apterous, smaller sized, male and oviparous female ; overwintering by anholocyclic form on grass root may be predominantly seen in some species (e.g. *nemoralis*). The grass feeding *Anoecia* are mostly visited by ants and those living a holocyclic life on grasses, may have their eggs laid in winter, collected and steered by ants *Lasius flavus* (e.g. *zirnitsi* Mordv.). *A. corni* is reported to be visited by as many as seven different species of ants of genera *Lasius*, *Myrica*, *Formica* etc., of which the most prevalent being *L. niger* (Zwölfer, 1957). Adults of *corni* and *pukoviea* Mord., are often reported from ants nest, sometimes kept in special cowhouses.

Parasitoids of *Anoecia* appear to be very few ; *Aclitus obscuripennis* Foerster has been recorded from *Anoecia* sp., and *A. vagans* ; *Paralipsis enervis*, a species known from widely diverse hosts, has been recorded from *Anoecis* sp., ; *Lysiphlebus macrocornis* is reported from *Anoecia* sp., and *A. vagans* ; *Lipolexis gracilis* Foerster is also known from *Anoecia* sp., besides a number of other aphid hosts ; of these 4 species of parasitoids, which are all known from European records. *A. obscuripennis* is exclusively known to parasitise species of *Anoecia* and *L. macrocornis* is also largely restricted to *Anoecia*, the only other host being *Brachycaudus helichrysi* (Kalt.).

All the six species of the genus *Anoecia* from India are only known by viviparae from Gramineous hosts ; of the six, *corni* (Fab.) *nemoralis* (Borner) and *vagans* (Koch) have *Cornus* as primary host in Europe.

Distribution : Cosmopolitan.

Type species : *Aphis corni* Fabricius 1775 ; location of types not known.

Key to the species of *Anoecia*

Apterous viviparous female ;

1. Dorsal hairs on abdomen fine, a few with spatulate or increassate apices.....2

Dorsal hairs on abdomen with flagellate apices, never with spatulate or increassate apices.....3

2. Marginal tubercles present on 1st-7th abdominal tergites. Antennal segment IV with 1-2 secondary rhinaria ; processus terminalis upto $0.50\times$ as long as base of segment VI. 8th tergite with to hairs. First tarsal segments with 6, 6, 7 hairs. Dorsal hairs long, stout and dense.....*A. vagans* Koch

Marginal tubercles absent on 5th and 6th tergites. Antennal segment VI without any secondary rhinaria ; processus terminalis upto $0.40\times$ as long as base of segment VI. First tarsal segments with 6, 6, 6 hairs.....*A. nemoralis* Börner

3. Ultimate rostral segment $0.80-0.5\times$ as long as second segment of hind tarsus ; longest hair on anterior tergites, $4.0-4.6\times$ as long as basal diameter of antennal segment III. 8th tergite with 11-12 hairs. First tarsal segments with 6, 6, 6 hairs.....*radictphaga* Pal & Raychaudhuri

Ultimate rostral segment $0.42\times$ as long as second segment of hind tarsus. Longest hair on anterior tergites upto $2.5\times$ as long as basal diameter of antennal segment III. 8th tergite with 9 hairs. First tarsal segments with 7, 7, 7 hairs.....*A. himalayensis* Chakrabarti & Maity

Alate viviparous females :

1. Dorsal hairs on abdomen with fine apices, a few with spatulate or incrassate apices.....2

Dorsal hairs on abdomen with flagellate apices and never with incrassate or spatulate apices.....3

2. Marginal tubercles present on 1st-7th tergite. Antennal segment VI with 2 secondary rhinaria. Ultimate rostral segment $0.75-0.80 \times$ as long as second segment of hind tarsus. Longest hairs with spatulate apices, on anterior tergites $2.0-2.1 \times$ as long as basal diameter of antennal segment III, First tarsal segments with 5, 5, 5 hairs.....*A. corni* (Fabricius)

Marginal tubercles absent on 5th and 6th tergites. Antennal segment VI usually without secondary rhinaria. First tarsal segments with 6, 6, 6 hairs.....3

3. Ultimate rostral segment $0.68-0.81 \times$ as long as second segment of hind tarsus and bearing 6 accessory hairs. Some hairs on the dorsum of abdomen, on 1st-7th tergites, may be with spatulate apices. Longest hair on antennal segment III about $3.2-3.6 \times$ as long as the basal diameter of the segment.....*A. nemoralis* Börner

Ultimate rostral segment $0.83-0.90 \times$ as long as second segment of hind tarsus and with 8 accessory hairs. Dorsal hairs only on posterior tergites with spatulate apices. Longest hair on antennal segment III. $2.8-3.0 \times$ as long as the basal diameter of the segment.....*A. furcata* (Theobald)

4. Longest cephalic hair $4.7-5.6 \times$ as long as the basal diameter of antennal segment III; longest hair on anterior tergites $4.0-5.0 \times$ as long as the mentioned diameter. Antennal segment III with 6-9 secondary rhinaria. First tarsal segments with 6, 6, 6 hairs.....*A. radiciphaga* Pal & Raychaudhuri

Longest cephalic hair $2.6-3.3 \times$ as long as the basal diameter of antennal segment III; longest hair on anterior tergites about $3.1-3.6 \times$ as long as the mentioned diameter. Antennal segment III with 12-14 secondary rhinaria. First tarsal segments with 7, 7, 7 hairs.....*A. himalayensis* Chakraborti & Maity

12. *Anoecia corni* (Fabricius)
(Figs. 98-106)

1775. *Aphis corni* Fabricius, J. C., *Systema Entomologiine*, 214.
 1841. *Schizoneura corni* Harting, T., *German's Z. f. Ent.*, 3 : 367.
 1852. *Schizoneura obsura* Walker, F., *List Hormopt. Ins. Brit. Mus.*, 4 : 1051.
 1895. *Schizoneura graminis* del Guercio, G., *Natur. Sicil.* (Palermo). 14 : 84.
 1950. *Anoecia agrustidis* Börner, C., *Neue Luropaische Biattausarten*, Naumburg, 17.
 1950. *Anoecia disculigera* Börner, C., *Neue Europaische Blattauarten*, Naumburg, 17.
 1957. *Anoecia corni*, Zowlfer, Helmut, *Z. ang. Ent.*, 40 (1) : 205.

Apterous viviparous female (fundatrix) : Body 2.07 mm long with 1.2 mm as maximum width. Head dark brown ; dorsal cephalic hairs fine, 0.083-0.100 mm long, $3.5-4.2\times$ as long as the basal diameter of antennal segment III. Antennae brown, slender, 5-segmented, $0.28\times$ as long as the body ; hairs on flagellum, sparse, fine, on segment III 0.040-0.050 mm long, upto $2.1\times$ as long as the basal diameter of the segment ; secondary rhinaria absent ; processus terminalis $0.31\times$ as long as base of last antennal segment. Eyes of 3 facets. Rostrum reaches hind coxae ; ultimate rostral segment (35), $0.85\times$ as long as second segment of hind tarsus and bears 4 accessory hairs. Tergum brown, sclerotic with pale transverse band-like intersegmental areas on thorax and between 6th and 7th and 7th and 8th abdominal tergites, besides in the marginal region ; dorsal hairs 0.050-0.080 mm long. Round flat marginal tubercles present on prothorax and I-VII, (except on V and VI in the specimen examined). Siphunculi small, pore-like, surrounded by fine hairs ; 8th tergite with 8 hairs. Cauda dark sclerotic. Legs brown to dark brown, pubescent, longest hair on hind tibiae 0.100 mm long, $1.7\times$ as long as the diameter at the middle of the tibia.

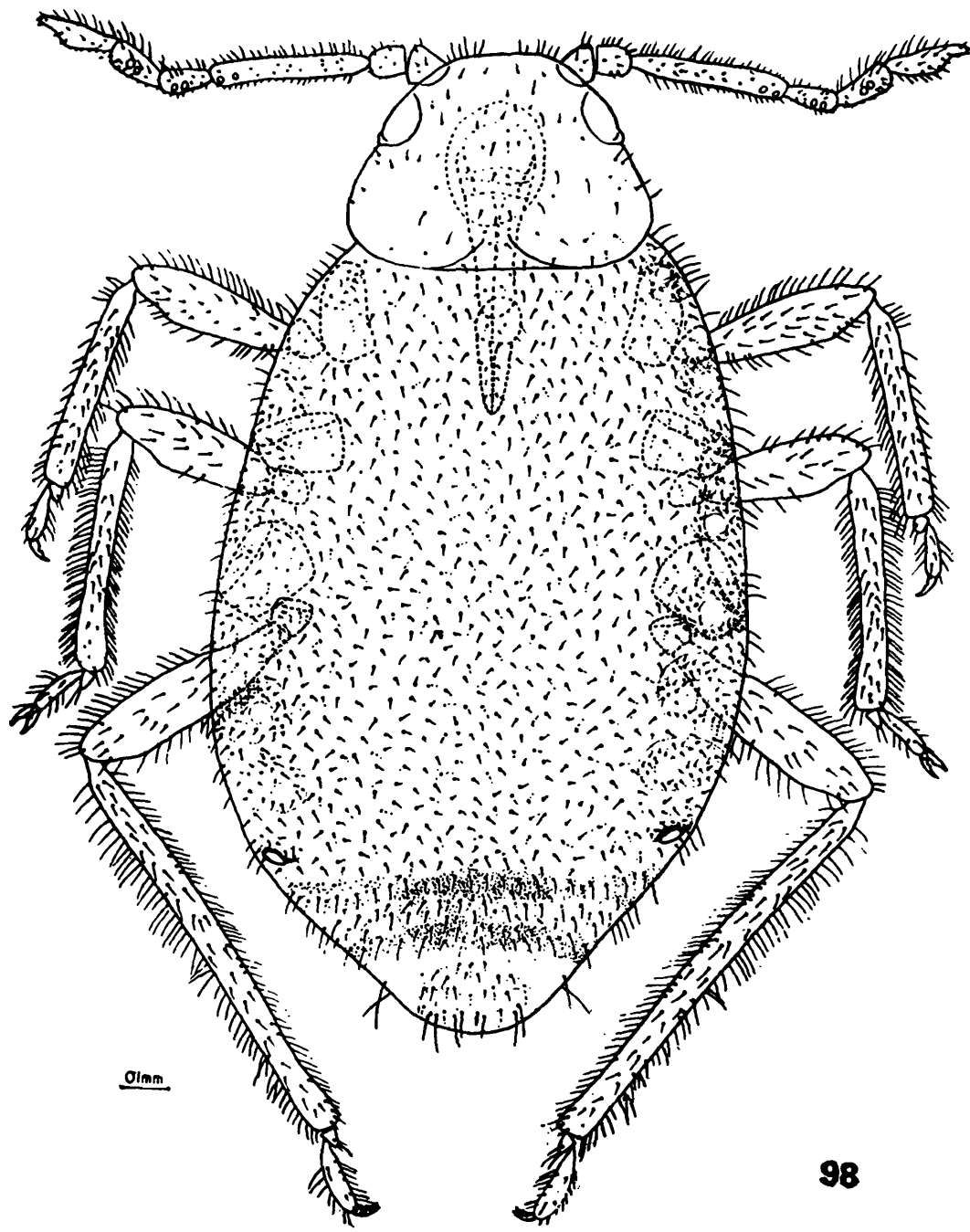
Colour : Light orange.

Measurements in mm :

Length	Width	Antenna	
			III
2.07	1.2	0.69	0.28

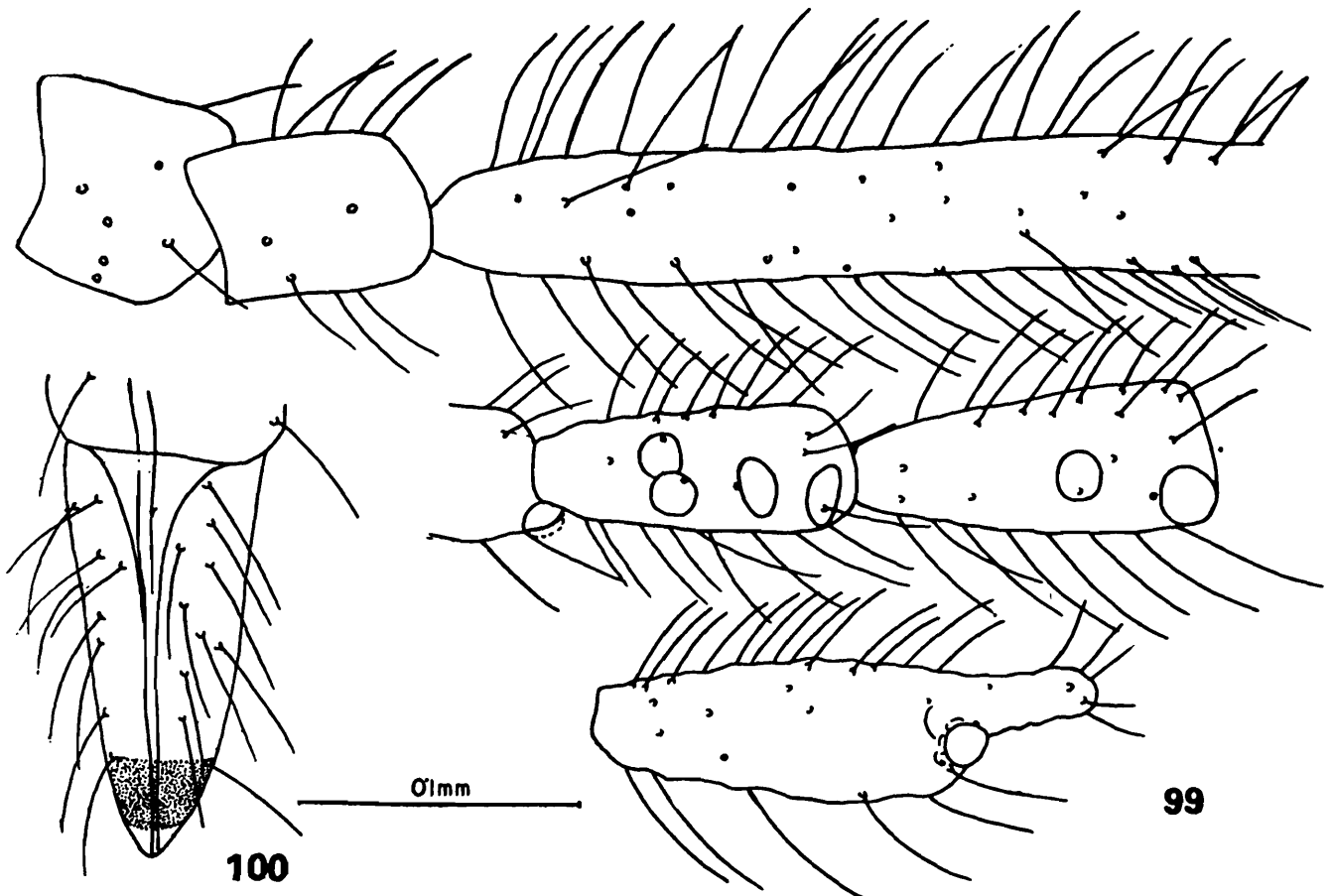
Antennal IV	segments V	urs	ht ₂
0.09	(0.046+0.115)	0.115	0.140

(ex Indet., Regent Park, England, 11.i.1976, BMNH Colls.).



Anoezia corni Apterous viviparous female : 98, whole body ;

Apterous viviparous female (on secondary host) : Body 2.34 mm long with 1.44-1.48 mm as maximum width. Head dark brown ; dorsal cephalic hairs 0.040-0.083 mm long, $2.0-3.5\times$ as long as the basal diameter of antennal segment III. Antennae dark brown, 6-segmented less than $0.50\times$ as long as the body ; segment III with 2-3 (0-10), IV with 1-4, V with 0-3 and VI with 0-1 secondary rhinaria ; hairs on flagellum fine, numerous, 0.050-0.083 mm long ; upto $3.5\times$ as long as the basal diameter of antennal segment III ; processus terminalis $0.37\times$ ($0.33\times$) as long as the base of antennal segment VI. Eyes of many facets. Ultimate rostral segment with at least 10 accessory hairs, $0.80\times$ as long as second segment of hind tarsus. Tergum sclerotised, bearing broad spinoplaural transverse sclerotic bands and paired marginal sclerites, which often become variably fused, specially on 3rd-6th tergites. Round flat marginal tubercles present on prothorax and 1st-7th abdominal tergites (sometimes absent on 5th or 5th and 6th tergites). Dorsal hairs irregularly arranged, acute, some-



Apterous viviparous female : 99, antenna ; 100, ultimate rostral segment.

times spatulate, 0.06-0.12 mm long ; 8th tergite with 11-12 hairs, upto 0.130 mm long. Siphunculi on large pores placed on sclerotic cones. Subgenital plate with about 32-34 hairs. Cauda with many fine hairs. Legs stout dark brown, pubescent ; longest hairs on hind tibiae 0.118 mm long, $1.6\times$ as long as the width at the middle of tibia.

Colour : Brown to greenish brown in life (Heie, 1980).

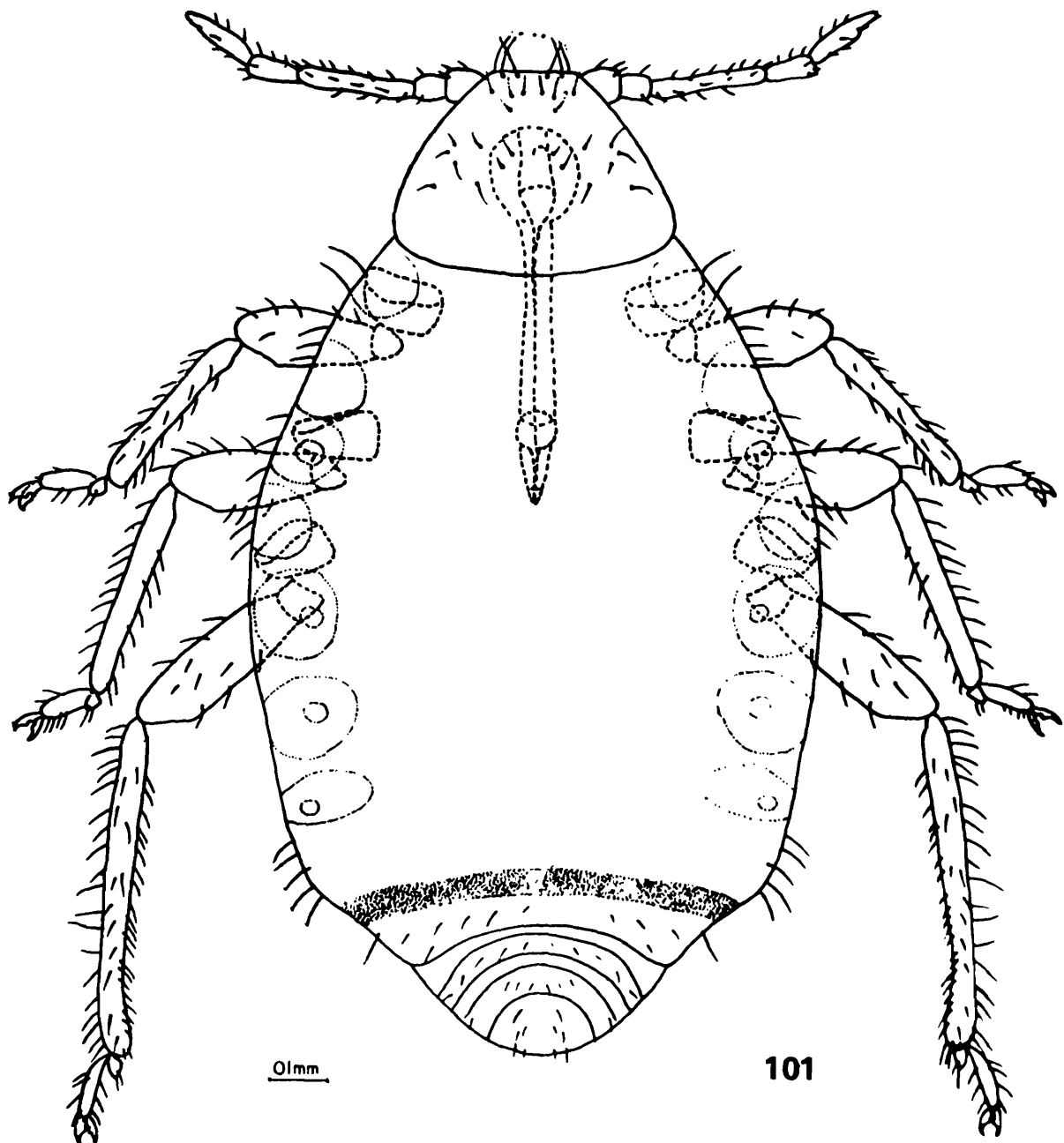
Measurements in mm :

	Length	Width	Antenna	III
1.	2.34	1.48	1.10	0.38
2.	2.34	1.44	1.10	0.37
	Antennal segments		urs	ht ₂
	IV	V	VI	
	0.15	0.15	0.15 + 0.05)	0.16 0.19
	0.14	0.15	(0.14 + 0.05)	0.16 0.19

(ex Grass root, Eagle field, England, 15.x.1975, BMNH Colls.).

Alate viviparous female (fundatrigeniae) : Body 2.07-2.14 mm long with 0.96-0.99 mm as maximum width. Head dark brown ; dorsal cephalic hairs fine, 0.033-0.050 mm long. Antennae 6-segmented $0.46\times$ as long as the body ; segment III with 9-10, IV with 3-5, V with 2-4 and VI with 0-2 round to oval secondary rhinaria ; hairs on flagellum fine, upto 0.058 mm long ; processus terminalis $0.42\times$ as long as base of segment VI. Eyes large. Ultimate rostral segment $0.75\times$ ($0.80\times$) as long as second segment

of hind tarsus and bears 10 accessory hairs. Abdominal dorsum with dark brown marginal sclerites on 1st-7th tergites, fragmented transverse sclerites on 1st and 2nd and complete sclerotic bands on 7th and 8th, besides a solid sclerotic patch on 3rd-6th tergites. Dorsal hairs numerous, acute 0.040-0.060 mm long, sometime longer hairs with spatulate apices ; 8th tergite with 8 fine hairs upto 0.112 mm long. Marginal tubercles large, round flat, conspicuous on 1st-7th tergites. Siphunculi on dark sclerotic coxes



Apterous fundatrix : 101, whole body.

bearing fine hairs. Cauda and anal plate with many fine hairs. Legs brown to dark brown with numerous fine hairs. First tarsal segments with 5, 5, 5 hairs. Forewings with pterostigma short, media once branched, hind wings with both obliques.

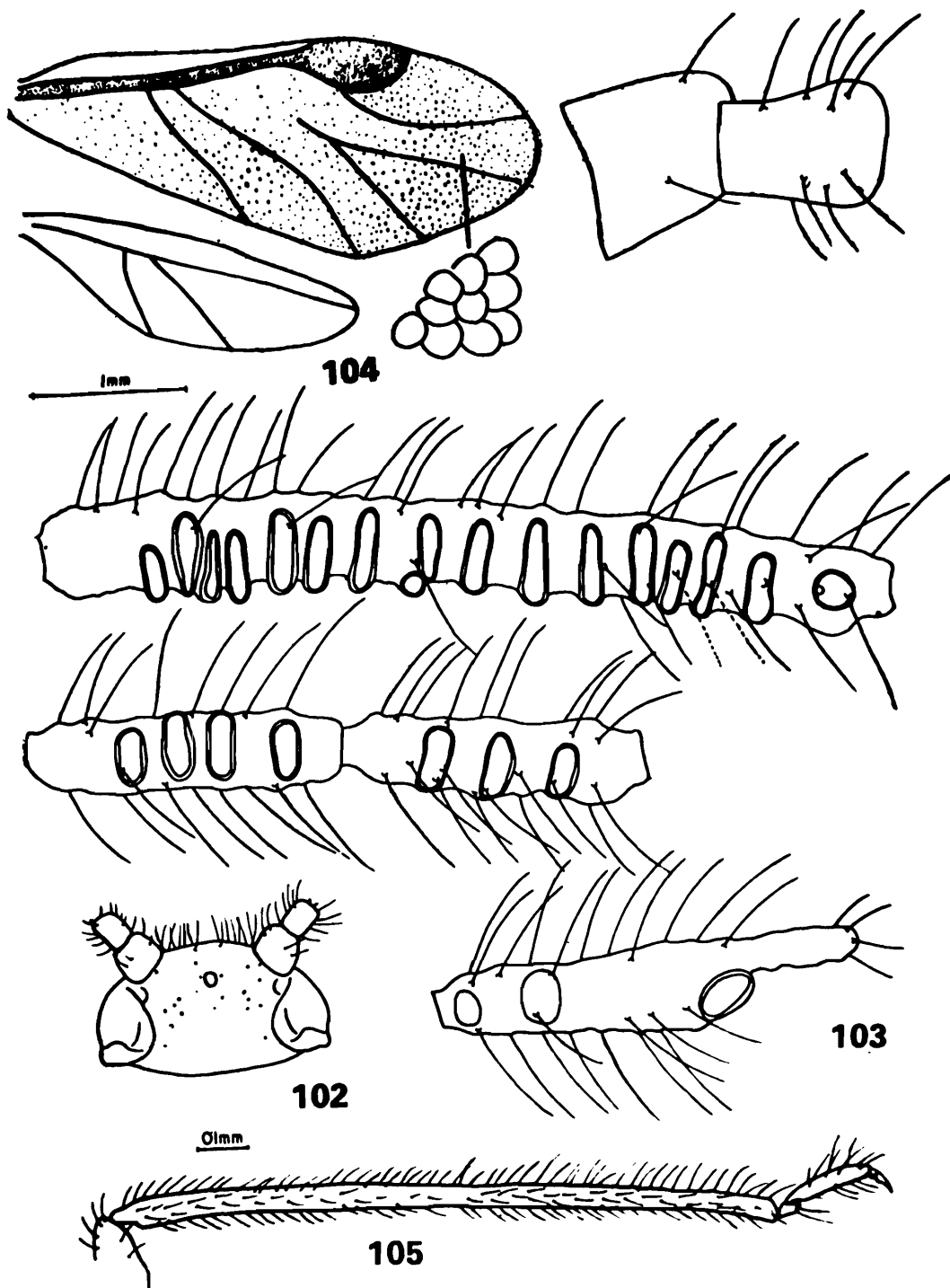
Colour : Blackish brown with bluish green abdominal spot (Heie, 1980).

Measurements in mm :

	Length	Width	Antenna		
1.	2.07	0.96	0.96		
2.	2.14	0.79	1.00		
	Antennal segments			urs	ht ₂
III	IV	V	VI		
0.33	0.14	0.15	(0.15 + 0.05)	0.16	0.20
0.34	0.14	0.15	(0.15 + 0.05)	0.15	0.20

(1, 2 ex *Cornus stolonifera*, Richmond, England, 9. vi.1976, BMNH Colls.).

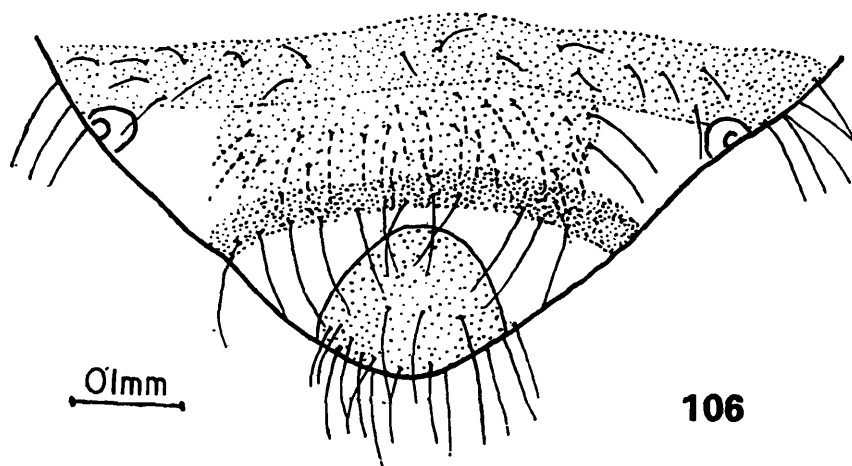
Alate viviparous female (Sexupara) : Body 2.76-2.96 mm long with 1.38 mm as maximum width. Head dark, sclerotic, bearing many fine hairs upto 0.100 mm long, 4.3× as long as the basal diameter of antennal segment III. Antennae dark, 6-segmented, 0.41-0.42× as long as the body, and bearing many fine hairs, 0.040-0.073 mm long, upto 3.0× as long as basal diameter of antennal segment III ; segment III with 12-16, IV with 3-4, V with 3 and base of VI with 1-2 semioval secondary rhinaria which appear distinctly protuberant in profile ; primary rhinaria protuberant ; processus terminalis 0.31-0.33× as long as base of segment VI.



Alate sexupara : 102, head ; 103, antenna ; 104, wings ; 105, part of hindleg ;

Eyes large with distinct ocular tubercles. Thoracic tergum dark sclerotic. Abdominal dorsum pale bearing paired black marginal sclerites on 1st-8th, fragmented spino-pleural sclerites on 1st-3rd, a solid sclerotic patch on 4th-6th, broad transverse sclerotic bands on 7th and 8th, part of spino-pleural patch on 6th and bands on 7th-8th become confluent with marginal sclerites ; spiracles on sclerotic plates ; flat round tubercles present on 1st-4th and on 6th and 7th ; dorsal hairs mostly with acute apices, on anterior tergites 0.033-0.040 mm long, $1.3-1.5\times$ as long as the basal diameter of antennal segment III ; 8th tergite with 12 hairs, upto 0.106-0.115 mm long. Siphunculi on sclerotic coxes and bear thick apical flange. Cauda semilunar, sclerotic, bearing 11-12 hairs. Legs dark, pubescent, longest hair on hind tibia upto 0.100-0.106 mm long, $4.0-4.1\times$ as long as the middle of the hind tibia. Wing veins dark ; fore wings with media once branched, hind wings with both obliques.

Colour : Brown in life.



Alate sexupara : 106, caudal region.

Measurements in mm :

	Length	Width	Antenna	III
1.	2.96	1.38	1.21	0.44
2.	2.76	1.38	1.22	0.49

Antennal segments			urs	ht ₂
IV	V	VI		
0.16	0.18	(0.18 + 0.06)	0	0.20
0.18	0.18	(0.17 + 0.06)	?	0.22

(1, 2, ex *Cornus stoloniofery*, Silwood Park, England, 22.x.1975, BMNH Coll. RPI 1489).

Sexual forms (not available ; description based on Heie, 1980).

Male : Apterous, slender 0.8-0.9 mm long. Antennae 5-segmented. Eyes large. Marginal tubercles as in oviparous females. Body hairs numerous, acute. Siphunculi absent.

Ovipara : Yellow or brownish in life, 12-13 mm long. Body elongated with head prothorax and cauda dark. Antennae 5-segmented. Eyes of only three facets. Marginal tubercles present on other segments as in viviparae but absent on 5th and 6th and often on 7th abdominal segments. Body hairs few, short.

Material examined : One apterous fundatrix from indet host. Regent Park, London, England, 27. iv. 1976, Coll. R. Paul. (RP 1877, BMNH Colls) ; Three apterae and one altatae from Grass roots, Eagle field, England, 15. x. 1975, Coll. R. Paul, (RP 1537, BMNH Colls.) ; two alate fundatrigeniae, from *Cornus stolonifera*, Richmond, England, 9. vi. 1976, Coll. R. Paul (RP 2019 RMNH Colls.) ; two alate sexuparae from *Cornus stolonifera*, Silwood Park, England, 22. x. 1975, Coll. R. Paul (RP 1489, BMNH Colls.).

Discussion.—Only two published records (each of one alate vivipara only) are available from Indian region (Banerjee *et al.*, 1969 ; Chakrabarti *et al*, 1970) but these specimens were not available during present study. It may be possible that till date no

authenticated material of *corni* has been collected from the region but there is strong possibility of its distribution in India in view of the known cosmopolitan distribution in all the continents except in Australia.

The species is known to have an obligatory host alternation between *Cornus* and various grasses (*Agrostis*, *Calamagrostis*, *Dactylus*, *Holcus*) Zöwlfer (1957) has studied the morphology and life history in details in Central Europe and Heie (1980) also mentioned in brief its biology in Scandinavia. Fundatrix and 2-3 generations of fundatrigenia develop on *Cornus* in spring and alate fundatrigenia move to grass roots where several generations of both apterous and alate viviparous female are known to be produced in summer, and during the autumn, the nymphs mature into alate sexuparae. Sexuparae return to *Cornus* and give birth to small sexuales. Ants of the genus *Lasius*, *Myrmica*, *Formica* are known to visit this species and syrphid predators (*Syrphus* spp.) and aphidiid parasitoids (*Aphidius* spp.) are recorded as natural enemy in Europe.

Distribution : Widespread in Europe ; Central Asia ; Middle East ; India (?), China, Korea, Japan ; North and South Africa ; North America.

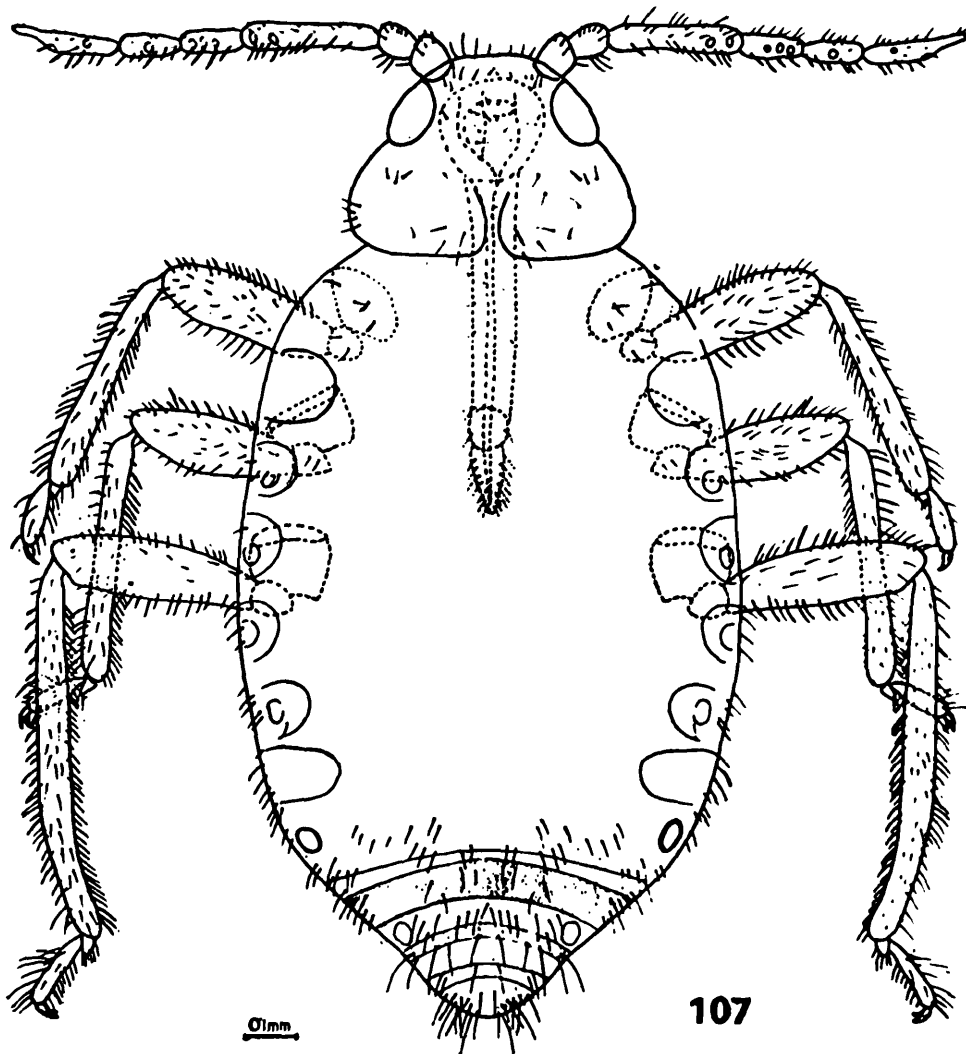
Types : Location of types not known.

13. *Anoecia furcata* (Theobald) (Figs. 107-114)

- 1915. *Forda furcata* Theobald F. V., *Entomologists Rec.*, **27** : 53.
- 1950. *Anoecia furcata*, Börner, C., *Neue europäische Blattlausarten* Naumberg, 1.
- 1957. *Anoecia furcata*, Zwölfer, Helmut, *Z. angew Ent.*, **40** : 217.
- 1982. *Anoecia furcata*, Chakraborti, S., Maity, S. P. and Bhattacharya, D. K. *Orient. Insects*, **16** (1) : 100.

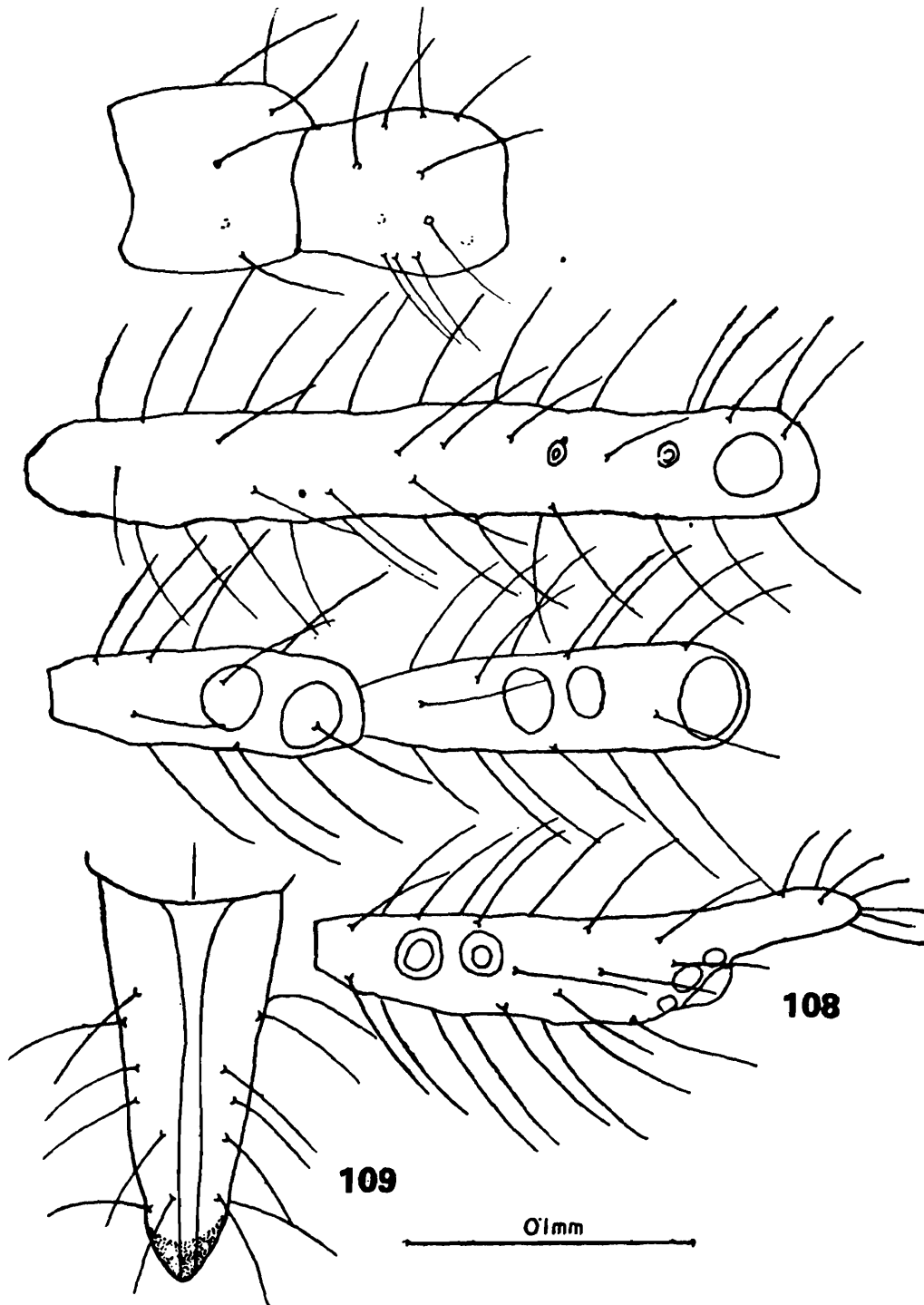
Apterous viviparous female (Not available from the region, description based on material from England) : Body 1.9-2.2 mm long with 1.19-1.20 mm as maximum width, brown to dark brown in colour. Head dark brown ; dorsal cephalic hairs, fine, acute, 0.040-0.073 mm long, $2.1-4.1 \times$ as long as the basal diameter of

antennal segment III. Antennae concolourous with the head, 6-segmented, $0.47-0.49 \times$ as long as body ; bearing many fine, somewhat stiff hairs, those on segment III, $0.040-0.70$ mm long, upto $4.0 \times$ as long as the basal diameter of the segment ; segment III with 2-3, IV with 2, V with 2 and VI with 2 large, round to oval secondary rhinaria ; processus terminalis $0.32-0.33 \times$ as long as the base of segment VI. Rostrum reaches hind coxae, ultimate rostral segment $0.78-0.80 \times$ as long as second segment of hind tarsus and bears 8 accessory hairs. Tergum brown, sclerotic, except some pale areas near bases of coxae and in between marginal sclerites upto 6th abdominal tergites ; a solid sclerotic patch formed on 4th-6th tergites ; 7th and 8th tergite each with a transverse sclerotic band ; hairs on the dorsum of abdomen with acute



Anoezia furcata (Theobald). Apterous viviparous female : 107, whole body.

apices, spinal hairs on anterior tergites 0.040-0.050 mm long, marginal hairs 0.050-0.066 mm long, these being 2.5-8.0 $\times$ and 3.0-4.0 $\times$ as long as the basal diameter of antennal segment III ; hairs on 7th tergite 0.050-0.055 mm long ; 8th tergite with 8-9 hairs, 0.100-0.115 mm long, 6.0-7.0 $\times$ as long as the mentioned



Alate viviparous female : 108, antenna ; 109, ultimate rostral segment.

diameter. Siphunculi with large pores, surrounded by whorl of hairs. Abdominal tergites 1st-5th, each with marginal tubercles. Cauda semicircular bearing fine hairs. Legs dark brown bearing numerous fine hairs which on hind tibiee upto 0.100 mm long, nearly twice as long as the width at the middle of the tibiae ; first tarsel segments with 6,6,6 hairs.

Colour : Brown in life.

Measurements in mm :

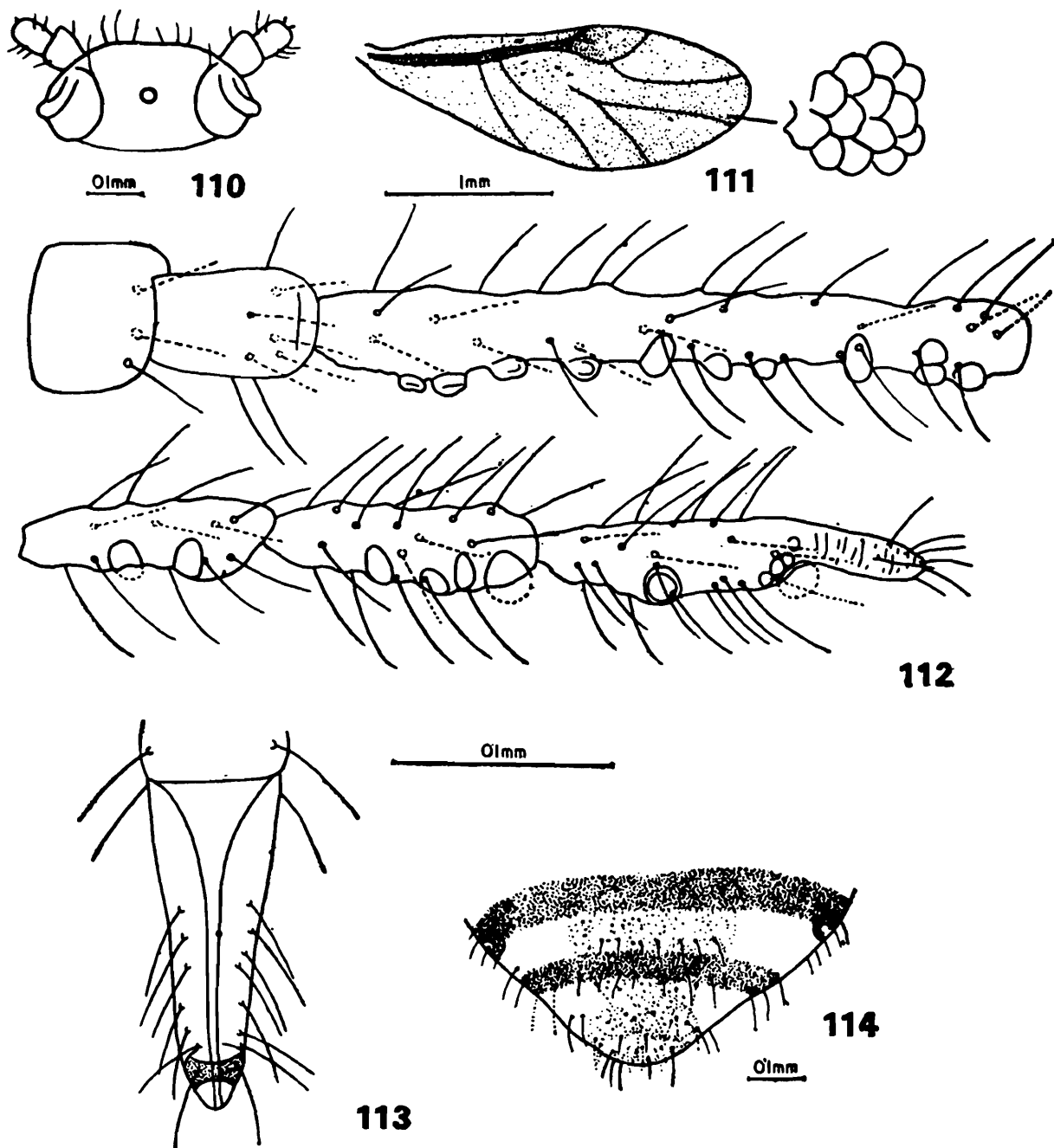
	Length	Width	Antenna
1.	2.10	1.19	0.98
2.	2.0	1.24	0.98

	Antennal segments			urs	ht ₃
III	IV	V	VI	urs	
0.31	0.12	0.14	(0.15+0.05)	0.15	0.19
0.32	0.13	0.14	(0.15+0.05)	0.15	0.18

(1, 2 ex ? *Poa annua*, Nottingham, Radcliff on Trent, England 22.×.1977, BMNH Colls.).

Alate viviparous female : Body 1.9-2.2 ml. long with 0.98-1.15 mm as maximum width. Head dark ; dorsal cephalic hairs fine, usually 0.040-0.50 mm long, upto 2.0-2.5× as long as the basal diameter of antennal segment III. Antennae dark, 6-segmented, 0.49-0.57× as long as the body ; hairs on flagellum fine, 0.020-0.076 mm long, longest one on segment III upto 3.0× as long as the basal diameter of the segment ; segment III with 9-12, IV with 3, V with 1-4 and VI with 0-1 protuberant secondary rhinaria ; processus terminalis 0.33-0.45× as long as base of segment VI. Rostrum reaches hind coxae, ultimate rostral segment 0.83-0.90× as long as second segment of hind tarsus and bears 8 accessory hairs. Abdominal dorsum with paired dark marginal sclerites

and broken spino-pleural sclerotic bands, those on 4th-6th tergites forming a solid patch ; 7th and 8th tergite each with a transverse sclerotic bank extending upto the lateral margin. Lateral marginal tubercles present on 1st, 4th and 7th tergites ; hairs on the dorsum of abdomen fine, stiff, a few on posterior tergite with aptulate apices, on anterior tergites upto 0.050 mm long, $3.0\times$ as long as



Alate viviparous female : 110, head ; 111, forewing ; 112, antenna ; 113, ultimate rostral segment ; 114, posterior portion of abdomen.

the basal diameter of antennal segment III ; 8th tergite with 9 hairs, 0.083-0.093 mm long, 4.1-5.0× as long as the mentioned diameter. Siphunculi with large pores encircled by 26-30 hairs. Cauda with 6 long fine hairs. Legs dark brown bearing many fine hairs ; first tarsal segments with 6,6,6 hairs. Forewings with pterosigma short, truncated ; media once branched, cubitus and anal separated ; hind wings with both obliques ; all veins darks.

Colour : Dark in life.

Measurements in mm :

	Length	Width	Antenna		
1.	1.93	0.99	0.99		
2.	2.07	0.98	1.10		
	Antennal segments			urs	ht ₂
III	IV	V	VI		
0.38	0.14	0.14	(0.15+0.05)	0.15	0.17
0.35	0.14	0.17	(0.17+0.05)	0.14	0.17

(1, ex indet, Silwood, England, 2. vii. 1976, BMNH Colls. ; 2, ex Grass root, Hanumanchoti, U.P., India, 13. vi. 1980, K.U. Colls.).

Other morphs : Not available. Zwolfer (1957) has given very brief notes on larvae and nymphs and sexuales.

Material examined : Two alate viviparous females from Grass roots, Hanumanchoti, Uttar Pradesh, India, 13. vi. 1980, Coll. S. Chakrabarti, det. H.L.G. Stroyan (K.U. Colls) ; five apterous viviparous females from *Poa annua*, Radcliff on Trent, Notts, England, 22. ×.1977 (BMNH Colls.) ; one alate viviparous female from indet host, Silwood, England, 2.vii. 1976, (BMNH Colls.).

Discussion : The alate viviparae described from India by Chakrabarti *et al.* (1982) show somewhat longer and more numerous

hairs. Zwölfer (1957) mentioned that european apterae may be 1.4-2.4 mm long with 0.8-1.4 mm as maximum width ; antennal segment III, IV, V and VI may be 0.21-0.28, 0.09-0.10, 0.10-0.12, 0.16-0.19 mm long ; the alatae in Europe may be 2.30-2.0 mm long with 1.10-1.25 mm as maximum width. Zwölfer (op. cit) has mentioned about its occurrence on *Cornus sanguinea*, *Bromus* spp. and *Deschampsia* in Central Europe where sexuparae appear in the months of September and October. The species is reported to be attended by ants, *Lasius flavus* and *Tetramorium caespitum*, in Europe. No natural enemy of this species is known. The species until recently was known only from Europe.

Distribution : India ; Uttar Pradesh, Europe.

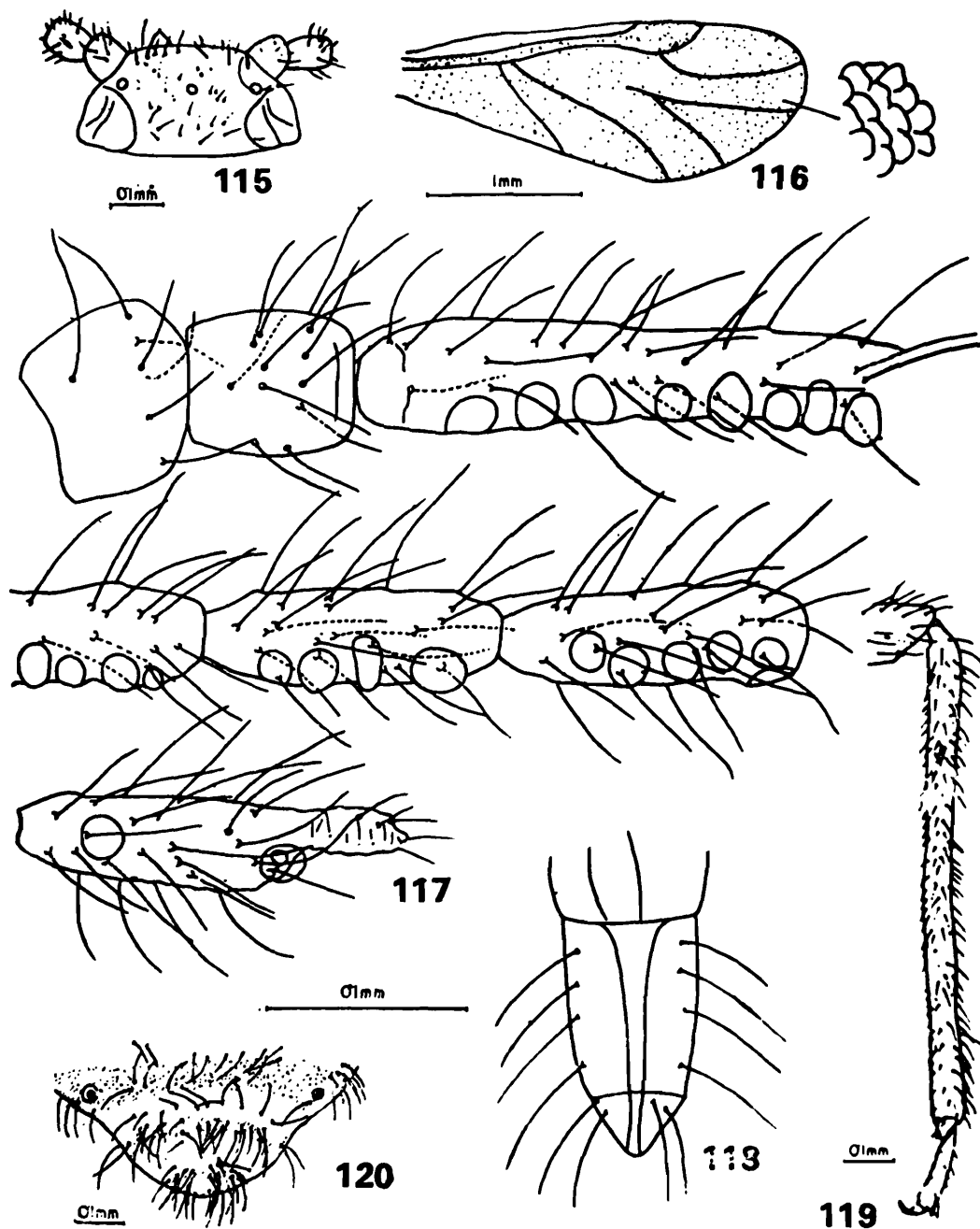
Types : In the collections of British Museum (Nat. Hist). London, England.

14. *Anoecia himalayensis* Chakrabarti & Maity (Figs. 115-120)

1978. *Anoecia himalayensis* Chakrabarti, S. and Maity, S. P. *Entomon*, 3 (2): 265.
1982. *Anoecia himalayensis*, Chakrabarti, S., Maity, S. P. and Bhattacharya, D. K. *Orient. Insects.*, 16 (1) : 100.

Apterous viviparous females : Body 1.97 mm long with 1.12 mm as maximum width. Head dark brown ; dorsal cephalic hair numerous, flagellate, upto 0.086 mm long, $2.6\times$ as long as the basal diameter of antennal segment III. Antennae 6-segmented, $0.63\times$ as long as the body ; hairs on the flagellum numerous, flagellate, longest one on segment III, 0.062 mm long, $1.8\times$ as long as the basal diameter of the segment ; segment III with 4, IV with 3-4, V with 2 and base of segment VI with 0-1 secondary rhinaria ; processus terminalis $0.38\times(0.33\times)$ as long as base of segment VI. Rostrum reaches mid coxae, ultimate rostral segment $0.42\times$ as long as second segment of hind tarsus and bears 7-8 accessory hair. Abdominal dorsum brown, smooth, pale on intersegmental areas ; 7th and 8th tergite each with a transverse sclerotic band ; hairs on the dorsum of abdomen numerous, fine on anterior tergites, upto 0.086 mm long, $2.5\times$ as long as the basal diameter of antennal segment III ; 7th tergite with 14 hairs, upto

0.072 mm long, 8th tergite with 9 flagellate hairs upto 0.079 mm long, these being $2.1\times$ as long as the mentioned diameter. Siphunculi on dark sclerotes, with about 25 hairs. Cauda with 8 hairs. Legs brown, pubescent ; hairs on femora long and fine,



Anoezia himalayensis Chakrabarti. Alate viviparous female : 115, head ; 116, forewing ; 117, antenna ; 118, ultimate rostral segment ; 119, part of hind leg ; 120, posterior portion of abdomen.

on hind tibiae upto 0.072 mm long, $1.0\times$ as long as the diameter at the middle of the tibia ; first tarsal segments with 7,7,7 hairs.

Colour : Brown in life.

Measurements in mm :

Length		Width		Antenna	
1.97		1.1		1.25	
III	Antennal segments			urs	ht ₂
	IV	V	VI		
0.34	0.16	0.16	(0.14+0.04)	0.38	0.91

(ex Grass root, Simla, Himachal Pradesh, 26. xi. 1972, K.U. Colls.)

Alate viviparous female : Body 2.0-2.1 mm long with 0.99-1.1 mm as maximum width. Head with numerous, fine, dorsal hairs upto 0.069-0.072 mm long, $2.6-3.3\times$ as long as the basal diameter of antennal segment III. Antennae 6-segmented, $0.50-0.55\times$ as long as the body ; flagellum smooth, brown ; hairs on the flagellum numerous, fine, longest one on segment III 0.065-0.083 mm long, $3.0-3.2\times$ as long as the basal diameter of the segment ; segment III with 12-14, IV with 3-4, V with 4-5 and base of segment VI with 0-1 secondary rhinaria, arranged in a row ; processus terminalis $0.37-0.44\times$ as long as base of antennal segment VI. Rostrum reaches mid coxae, ultimate rostral segment $0.67-0.78\times$ as long as the second segment of hind tarsus and bears 8 accessory hairs. Abdominal dorsum pale brown, with 8 solid sclerotic patch on 3rd-6th tergites besides segmental marginal scleroties and transverse sclerotic bands on each of the 7th and 8th tergites ; sclerotic patches over tergum appear wrinkled ; hairs on the dorsum of abdomen numerous, mostly flagellate, 16-45 per segment on 1st-6th tergites, these being upto 0.076-0.086 mm long, $3.1-3.6\times$ as long as the basal diameter of antennal segment III ; 7th tergite with 12 hairs, upto 0.083-0.090 mm long, and 8th tergite with 10 hairs, upto 0.107-0.121 mm long, these being $3.2-4.0\times$ and $4.3-5.0\times$ as long as the mentioned diameter respectively. Siphunculi

on dark sclerites, with 20-21 hairs. Cauda with 14 hairs. Subanal plate with 10-11 hairs. Subgenital plate with 16-18 short hairs. Legs dark brown, pubescent ; hairs on femora and tibiae upto 0.052-0.093 mm long, longest one on hind tibiae upto 0.079-0.093 mm long, 3.4-3.8× as long as the diameter at the middle of the tibia ; empodial hairs shorter than the claws ; first tarsal segments with 7,7,7 hairs. Wing venation pale ; forewings with media once branched, arising away from pterostigma ; hind wings with both obliques.

Colour : Brown with dark brown abdomen.

Measurements in mm :

	Length	Width	Antenna	III
1.	2.04	1.03	1.14	0.39
2.	2.00	1.06	1.13	0.39
	Antennal segments		urs	ht ₂
IV	V	VI		
0.16	0.18	(0.13+0.05)	0.14	0.18
0.16	0.18	(0.14+0.06)	0.13	0.20

(1, ex Grass root, Simla, H.P., 26. xii. 1972, K.U. Colls ; 2, ex Grass root, Simla, H.P. 26. xi. 1972, K.U. Colls.)

Other morphs : Not available.

Material examined : One apterous and one alate viviparous female, from Grass root, Simla, Himachal Pradesh, India, 26. xi. 1972 ; one alate viviparous female from Grass root, Simla, Himachal Pradesh, India, 26. xii. 1972, Coll. S. Chakrabarti (Paratypes ; K.U. Colls.).

Discussion : The species has only been known from north-eastern India, infesting secondary host i.e. unidentified grass roots,

during the months of November and December. It forms another member of the subgroup *Anoecia corni* and related species, under *Anoecia* s.s., sensu Börner, but can be separated from related Indian species following the key. Details of biological data on the species is not available.

Distribution : India : Uttar Pradesh ; Himachal Pradesh.

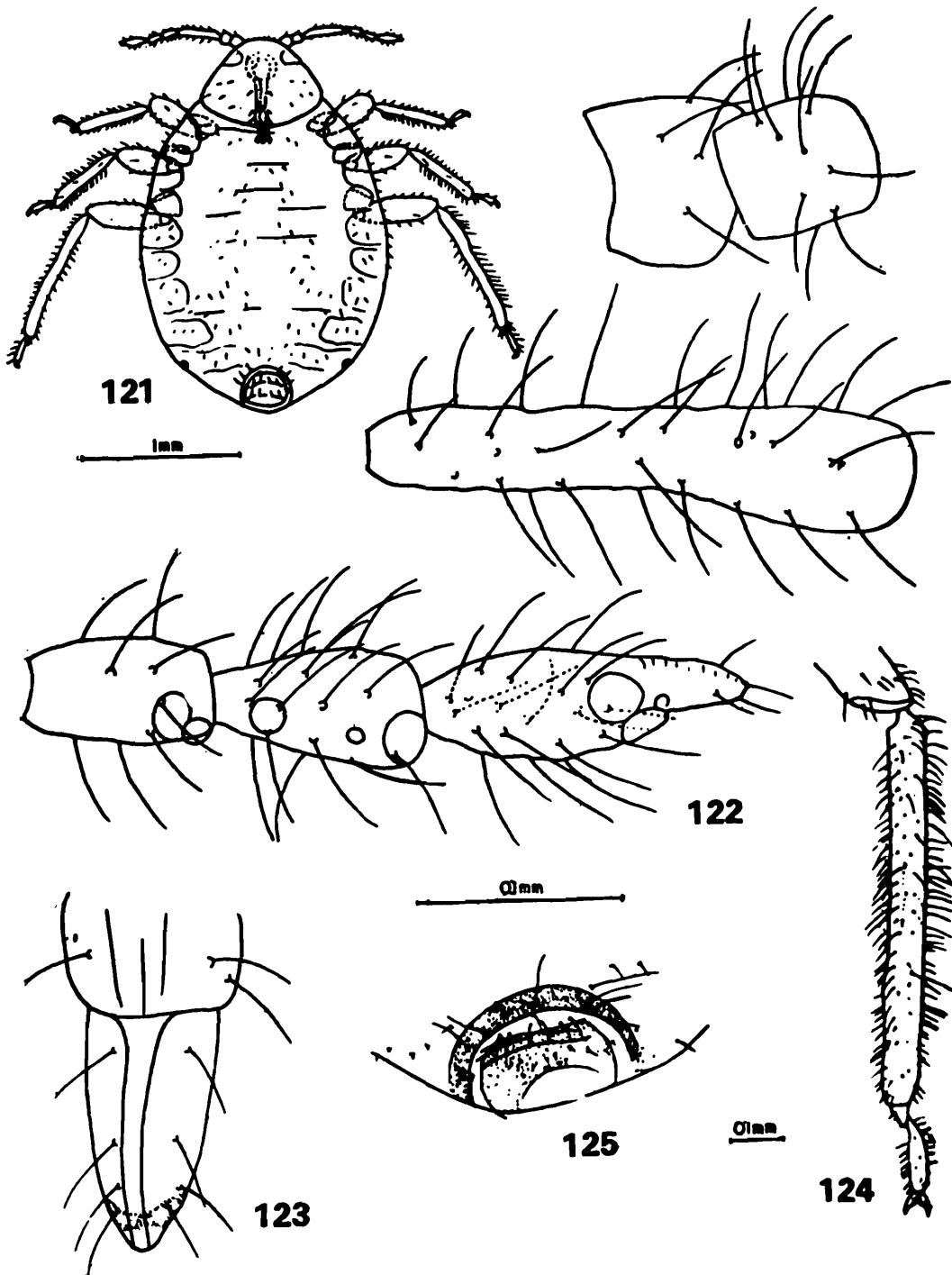
Types : In the collections of Biosystematic Research Unit, Department of Zoology, University of Kalyani, West Bengal, India.

15. *Anoecia nemoralis* Börner (Figs. 121-132)

1950. *Anoecia nemoralis* Börner C., *Neue suropaische Blattlausarten*, 17.
 1957. *Anoecia nemoralis*, Zwölfer, Helmut, *Z. angew Ent.*, **40** : 214.
 1980. *Anoecia nemoralis*, Hele, Olc E., *Fauna ent. scand.*, **9** : 107.
 1982. *Anoecia nemoralis*, Chakrabarti, S., Maity, S.P., Bhattacharya, D. K., *Orient. Insects*, **16** (1) : 102.

Apterous viviparous female : Body 2.2—2.4 mm long with 1.3—1.4 mm as maximum width. Dorsal cephalic hairs fine, 0.070—0.083 mm long, longest one on venter $4.0\text{--}4.4\times$ as long as the basal diameter of antennal segment III. Antennae 6-segmented, about $0.3\text{--}0.4\times$ as long as the body ; hairs on the flagellum 0.046-0.060 mm long, longest one on segment III $2.8\text{--}3.6\times$ as long as the basal diameter of antennal segment III ; segment III with 3-4, rarely with 7, IV with 1-3, V with 0-1 secondary rhinaria usually occurring on distal half of the segments ; processus terminalis $0.3\text{--}0.4\times$ as long as base of antennal segment VI. Rostrum reaches near ? hind coxae, ultimate rostral segment $0.60\text{--}0.90\times$ as long as second segment of hind tarsus and bears 6 accessory hair. Abdominal dorsum with a brown or dark brown sclerotised patch covering at least 3rd—6th tergites, except some intersegmental pale marginal areas ; 7th and 8th tergites each with a dark band, as also 1st and 2nd ; hairs on the dorsum of abdomen numerous, with acute, incrassate or spatulate apices ; marginal and spinal hairs (0.016—0.033 mm) shorter than pleural hair (0.080 mm) ; longest spinal hair on anterior tergites being $1.2\text{--}1.8\times$ and pleural hair upto $4.0\times$ as long as the basal diameter of antennal segment III, respectively ; 7th and 8th tergites each with 8 hairs, upto $2.2\text{--}2.8\times$ and $6.0\text{--}7.0\times$ as long as the mentioned dia-

meter, respectively. Marginal tubercles present on prothorax, abdominal segments 1-4 and on 7. Siphunculi with about 20-25 hairs around the pores. Cauda with 4 hairs. Subgenital plate with two groups of hairs, 8-10 on anterior portion and 25-30 on posterior



Anoecia nemoralis Börner. Apterous viviparous female : 121, whole body ; 122, antenna ; 123, ultimate rostral segment ; 124, part of hind leg ; 125, caudal region ;

portion. Legs dark brown, stout, pubescent ; longest hair on hind tibiae 0.090–0.100 mm long, $1.1–1.2\times$ as long as the diameter at the middle of hind tibia ; first tarsal segments with 6, 6, 6 hair ; second tarsal segment with many long fine hairs.

Colour : Green or blackish brown in life.

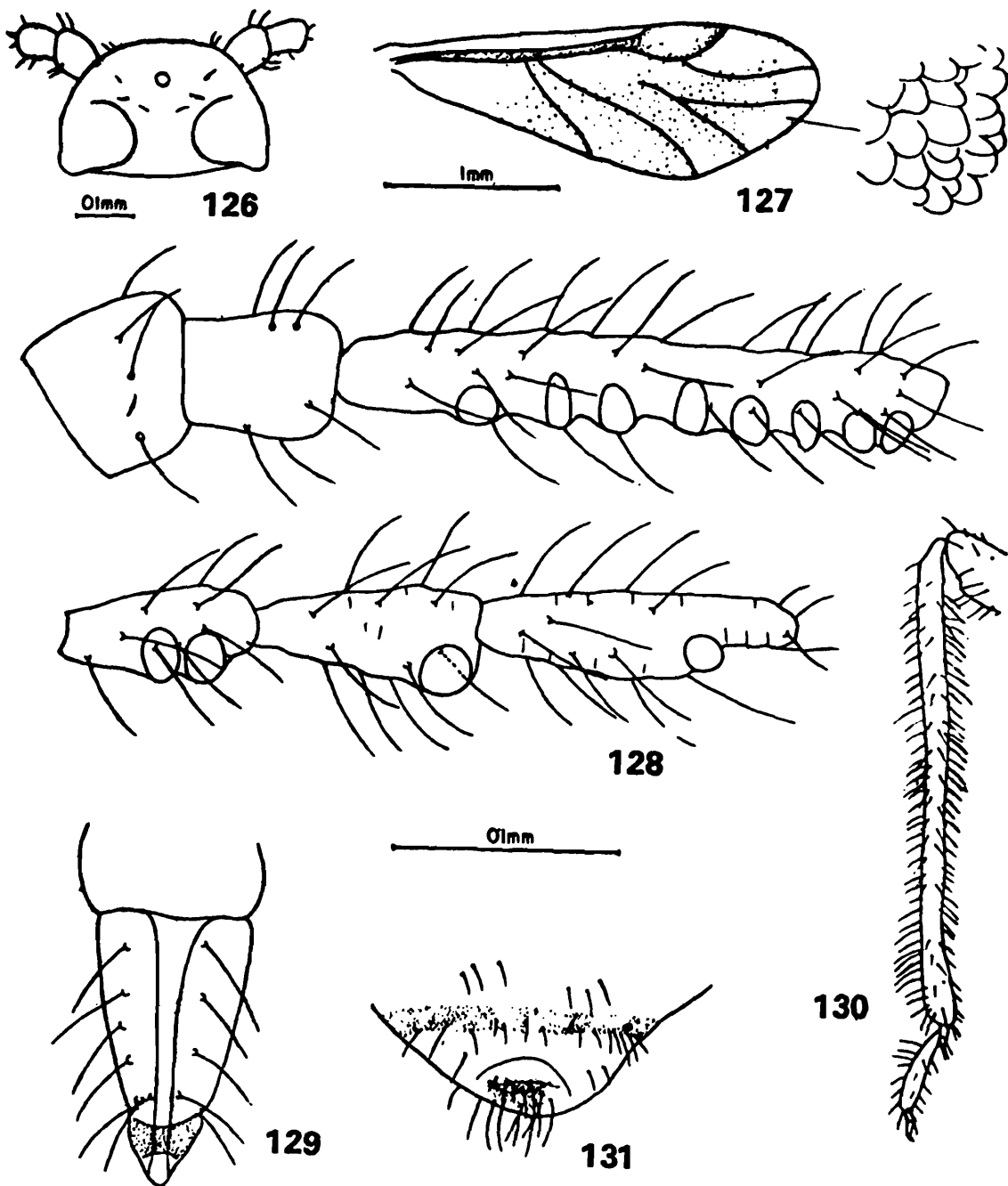
Measurements in mm :

	Length	Width	Antenna		
1.	2.48	1.55	0.84		
2.	2.31	1.37	0.83		
	Antennal segments			urs	ht ₂
III	IV	V	VI		
0.27	0.09	0.11	(0.14+0.04)	0.13	0.18
0.29	0.10	0.10	(0.13+0.04)	0.11	0.19

(1, 2, ex *Triticum* roots, Jankichoti, Uttar Pradesh, 15.vi.1980, K.U. Colls.).

Alate viviparous female : Body 2.11–2.30 mm long with 1.0–1.1 mm as maximum width. Dorsum of head with about 18-20 hairs, 0.050-0.053 mm long, longest one about $3.6–4.4\times$ as long as the basal diameter of antennal segment VI. Antennae 6-segmented, $0.36–0.40\times$ as long as the body ; hairs on the flagellum 0.06–0.066 mm long, longest one on segment III $3.2–3.6\times$ as long as the basal diameter of the segment ; segment III with 7-10, IV with 2-4, V with 0–3 secondary rhinaria, sometimes base of segment VI with 0-2 similar rhinaria ; processus terminalis $0.33–0.37\times$ as long as base of antennal segment VI. Ultimate rostral segment $0.68–0.81\times$ as long as second segment of hind tarsus and bears 6 accessory hairs. Abdominal dorsum bearing large wax pores and segmental, spinal, pleural and marginal sclerites, which may be fused (spinal and pleural) on 3rd–6th tergites into a solid patch ; the patch sometimes appear to be hairless (Heie, 1980) ; 7th and 8th tergites each with a spinopleural sclerotic band ; hairs on the dorsum of abdomen

0.026—0.030 mm long, some with spatulate apices, on anterior tergites upto $1.4\text{--}1.6\times$ as long as the basal diameter of antennal segment III, 7th tergite with 5-6 and 8th tergite with 8-9 hairs, upto $3.2\text{--}3.6\times$ and $5.4\text{--}6.0\times$ as long as the mentioned diameter. Siphunculi surrounded by more than 20 hairs. Cauda with many fine hairs. Legs dark brown, with bases of femora paler ; femora and tibiae pubescent ; longest hair on hind tibiae equal to the diameter at the



Alate viviparous female : 126, head ; 127, forewing ; 128, antenna ; 129, ultimate rostral segment ; 130, part of hind leg ; 131, caudal region ;

middle of tibia ; first tarsal segments with 6,6,6 hairs. Wing venation normal, dusky.

Colour : Blackish brown in life.

Measurements in mm :

	Length	Width	Antenna		
1.	2.13	1.04	0.82		
2.	2.30	1.12	0.86		
	Antennal segments			urs	ht ₂
III	IV	V	VI		
0.30	1.10	0.12	(0.11+0.03)	0.14	0.18
0.29	0.11	0.11	(0.11+0.04)	0.13	0.19

(1, 2 ex *Triticum sativum*, Jankichoti, Uttar Pradesh, 15.vi.1980, K. U. Colls.).

Larva (based on Börner *et al.*, 1957).—The young larvae have 4 spatulate marginal setae on each side of thoracic segments. Vertex with 10 long setae and 1-2 spinal setae with spatulate apices. On the stalk and roots of *Poa nemoralis*.

Nymph (Alate ; late stage) : Body pale, 1.93 mm long with 1.10 mm as maximum width. Antennae pale, 6-segmented, 0.69 mm long; hairs on antennae fine, 0.016—0.040 mm long, always shorter than basal diameter of antennal segment III ; secondary rhinaria absent ; processus terminalis about $0.32\times$ as long as base of segment VI. Ultimate rostral segment 0.130 mm long, $0.88\times$ as long as second segment of hind tarsus and bears 4 accessory hairs. Abdominal dorsum pale ; hairs on dorsum of abdomen thick, 0.016—0.050 mm long ; 7th tergite with 6 hairs, 0.046-0.053 mm 8th tergite long; with 8 hairs, with acute apices, upto 0.115-0.118 mm long. Siphunculi on small coxae and with large pores, legs thick, stout, pubescent ; hairs on femora and tibiae fine, on hind tibiae upto 0.066 mm long, $0.86\times$ as long as the diameter at the middle of the tibia ; all tibiae with series of transverse striations.

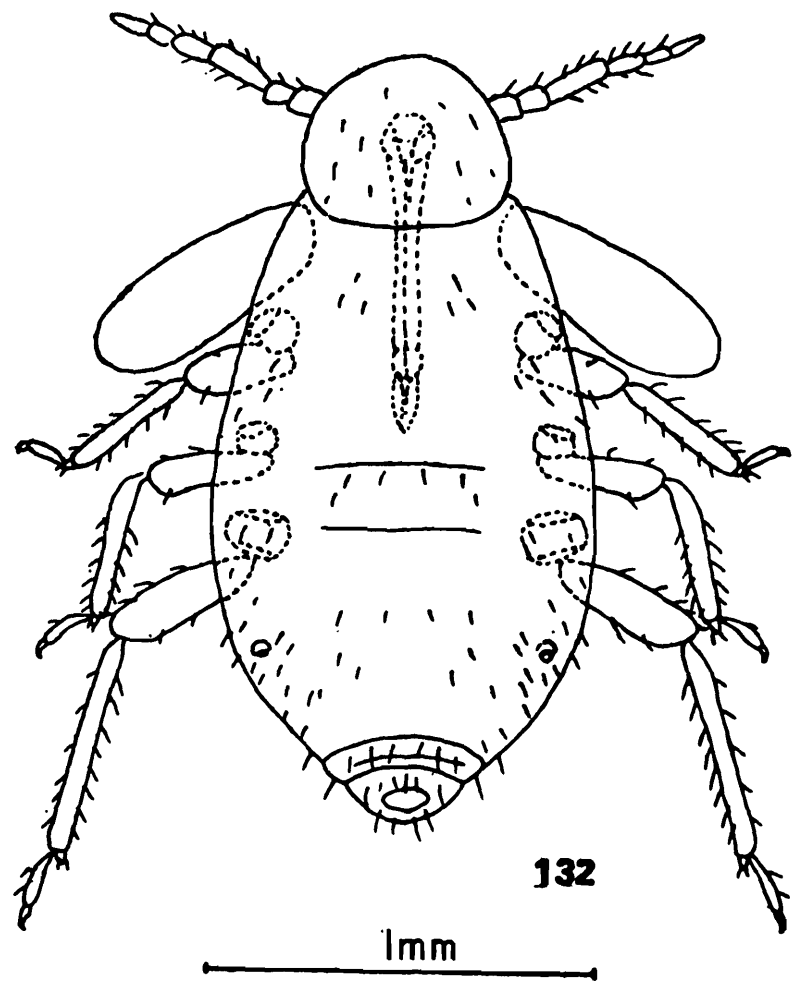
Colour : Pale brown in life.

Measurements in mm.—

Length	Width		Antenna		
1.93	1.10		0.69		
	Antennal segments			urs	ht ₂
III	IV	V	VI		
0.19	0.07	0.90	(0.10+0.03)	0.130	0.146

(ex *Triticum sativum*, Jankichoti, U.P. 15.vi.1980, K.U. Colls.).

Material examined : Two apterous viviparous females, two alate viviparous females and two nymphs from roots of *Triticum* sp.,



Alate nymph : 132, whole body.

jankichoti, Uttar Pradesh INDIA, 15.vi. 1980. Coll. S Chakrabarti (K. U. colls.).

Discussion : In Central Europe, *Cornus sanguinea* is considered as primary host ; while fundatrix and apterous fundatrigenia on *Cornus* have been described (Zöwlfer, 1957) and are considered similar to the same morphs of *corni* (Fabricius), alate fundatrigenia remain unknown (Heie, 1980). The species is reported to overwinter as anholocyclic morph on grassroots in ant's nest in Europe. Zwölfer (1957) and Stroyan (1964) recorded plants of genera *Agropyrum*, *Alopecura*, *Arrhenatherum*, *Bromus*, *Deschampsia*, *Festuca*, *Panicum*, *Phleum*, *Poa* and *Sieglingia* as food plants of *nemoralis* but records of occurrence of the species on roots of *Triticum* further extends the host range. The species is myrmecophilous, attended and cared by ants *Lasius flavus* and *L. niger* and occasionally by ants of *Formica* and *Tetramorium* species, in India. Syrphid larvae may also predate on this species.

Zwölfer (1957) has given extensive description of adult apterae, alatae and larvae and discussed in details about its biology in Central Europe.

Distribution : INDIA : Uttar Pradesh ; GREAT BRITAIN ; FRANCE ; GERMANY ; POLAND ; CZECHOSLOVAKIA ; HUNGARY ; SWEDEN ; U.S.S.R.

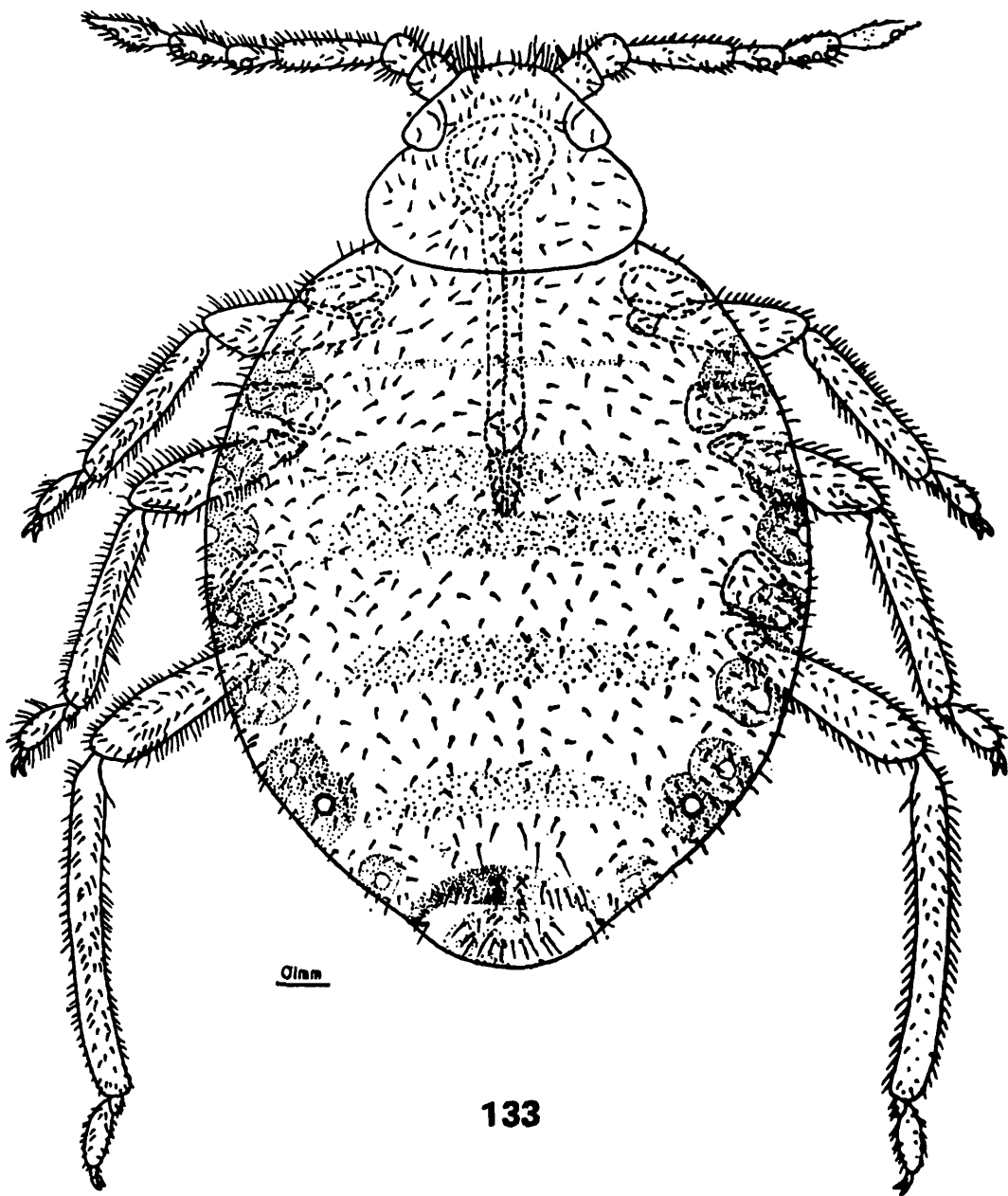
Types : Location of types not known ; may be in Börners own collections in Naumberg Branch office of the Biologischen Reichsanstalt, East Germany.

16. *Anoecia radiciphaga* Pal and Raychaudhuri (Figs. 133-141)

- 1977. *Anoecia radiciphaga* Pal, P. K., and Raychaudhuri, D. N., *Orient. Insects*, **11** : 374.
- 1980. *Anoecia radiciphaga*, Raychaudhuri, D. N., Ghosh, A.K., Pal, P. K., *In Aphids of North East India and Bhutan*, 46.
- 1982. *Anoecia radiciphaga*, Chakrabarti, S., Maity, S. P., Bhattacharya, D. K., *Orient. Insects*, **17** (1) : 100.

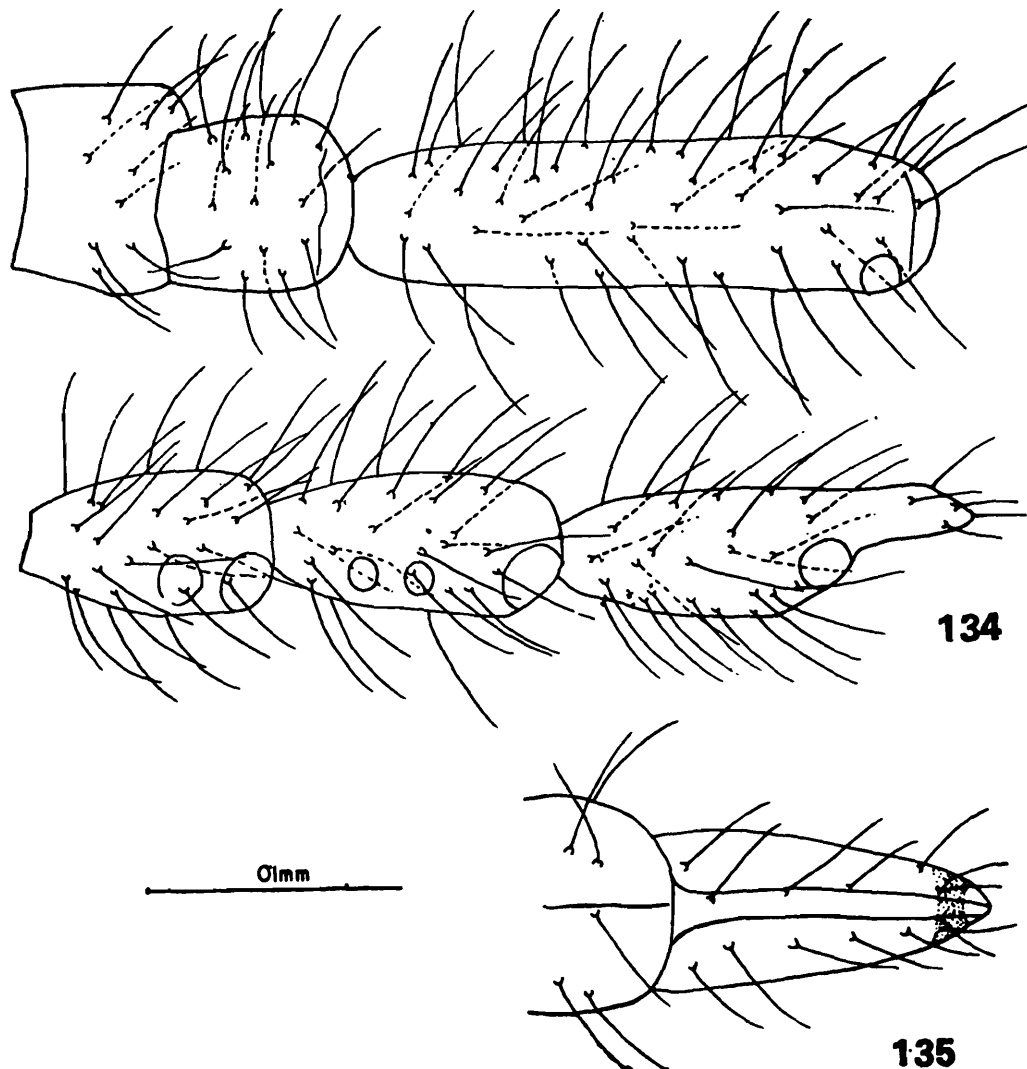
Apterous viviparous female : Body 1.7—2.10 mm long with 1.2 1.4 mm as maximum width. Head brown with numerous fine dorsal

hairs, upto 0.07-0.09 mm long, $4.0-4.6\times$ as long as the basal diameter of antennal segment III. Antennae brown to dark brown, 6-segmented, $0.40-0.45\times$ as long as the body ; flagellum smooth densely covered with hairs, longest one on segment III 0.05—0.08 mm long, $3.4-4.0\times$ as long as the basal diameter of the segment ; segment III with 0-1, IV with 1-3, V with 0-2 round, protuberant secondary rhinaria ; processus terminalis $0.31-0.32\times$ as long as the



Anoecia radiciphaga Pal & Raychaudhuri. Apterous viviparous female ; 133, whole body.

base of antennal segment VI. Rostrum reaches mid-coxae, ultimate rostral segment $0.80-1.05\times$ as long as the second segment of hind tarsus and bears 8-10, fine, accessory hairs. Thoracic tergum dark brown. Abdominal dorsum pale brown, with a dorsal sclerotic patch extending over 1st-6th segments; hairs on 1st-6th tergites numerous, flagellate, $0.066-0.080$ mm long, upto $4.0-4.6\times$ as long as the basal diameter of antennal segment III; 7th tergite with 10-17 hairs, $0.060-0.087$ mm long and 8th tergite with 11-12 hairs, $0.083-0.100$ mm long, these being $3.8-5.5\times$ and $4.8-6.0\times$ as long as mentioned diameter, respectively. Siphunculi on brown cones, with 35-40 fine hairs. Cauda with numerous fine hair. Subanal plate entire; with many fine hairs. Legs dark brown with numerous fine hairs, ($0.050-0.083$ mm), longest one on hind tibiae $0.083-0.086$ mm long, $1.1-1.2\times$ as long as the



Apterous viviparous female : 134, antenna ; 135, ultimate rostral segment.

diameter at the middle of the tibia ; first tarsal segments with 5, 6, 6 hairs.

Colour : Greenish to orange in life.

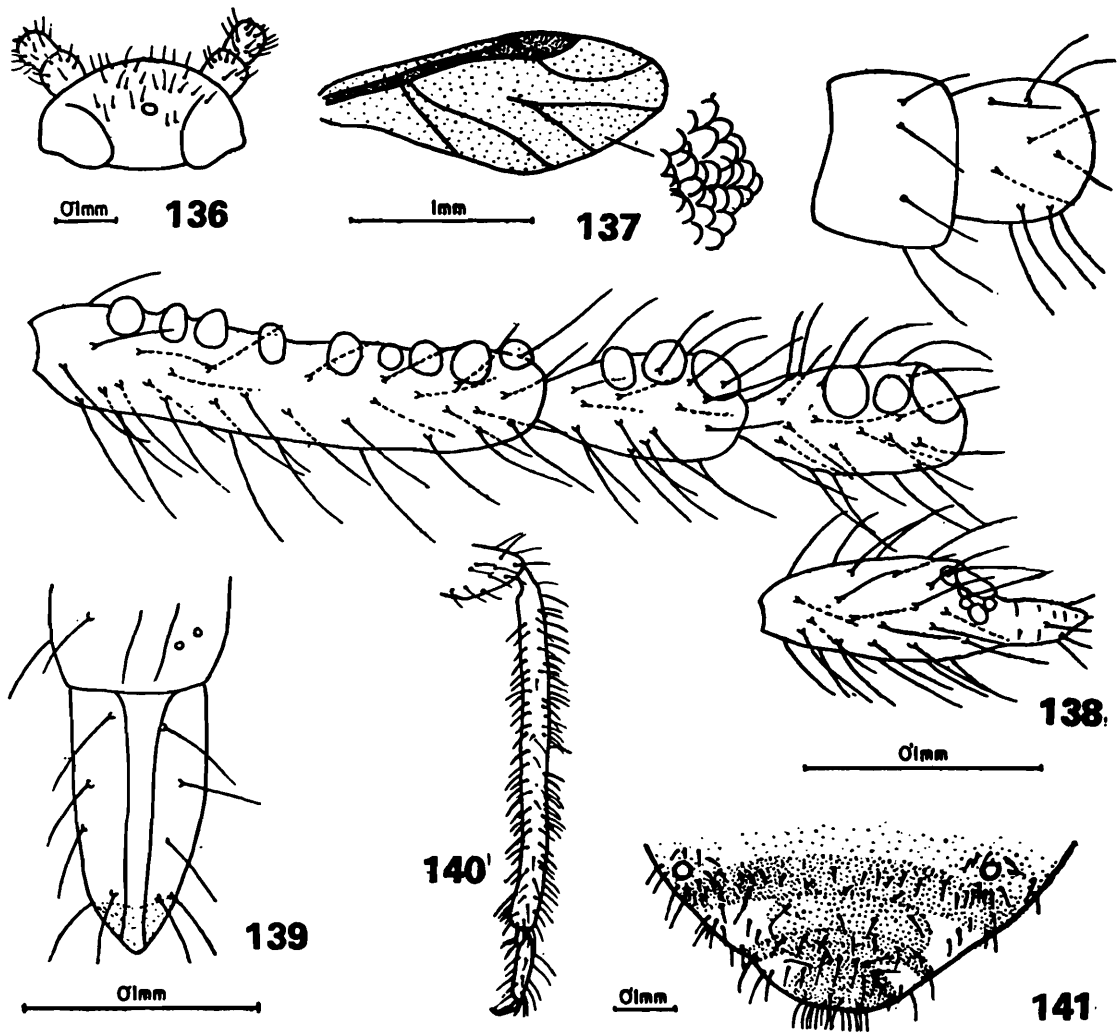
Measurements in mm :

	Length	Width	Antenna		
1.	1.96	1.25	0.81		
2.	2.03	1.26	0.84		
	Antennal segments			urs	ht ₂
III	IV	V	VI		
0.25	0.12	0.11	(0.13+0.04)	0.16	0.18
0.25	0.11	0.11	(0.13+0.04)	0.15	0.17

(1, 2 ex Grass, Ghoom, Darjeeling, West Bengal, 18.v.1972, C. U. Colls.).

Alate viviparous female : Body 1.56—1.90 mm long with 0.96—1.2 mm as maximum width. Head brown ; dorsal cephalic hairs fine, numerous, upto 0.09—0.10 mm long, $4.7.5.6\times$ as long as basal diameter of antennal segment III. Antennae brown, 6-segmented, $0.40-0.50\times$ as long as the body ; flagellum smooth at least on the margin ; hairs as the flagellum fine, longest one on segment III, 0.050—0.053 mm long, upto $3.8-40.\times$ as long as the basal diameter of the segment ; segment III with 6-9, IV with 3, V with 1-3 and base of VI with 0-1, semicircular to oval secondary rhinaria ; processus terminalis $0.30-0.40\times$ as long as base of antennal segment VI. Rostrum reaches little beyond midcoxae, ultimate rostral segment $0.75-0.90\times$ as long as second segment of hind tarsus and bears 7-8 long, accessory hairs. Abdominal dorsum pale bearing a large, brown, median sclerotic patch over 3rd-6th tergites besides the brown spinal patch on 1st and 2nd tergites, pleural patches on each of 1st-4th tergites and transverse sclerotic band on 7th and 8th tergites ; hairs on the dorsum of abdomen fine, 0.033—0.050 mm long, upto $4.0-5.0\times$ as long as the basal diameter of antennal segment ; longest hair on 8th tergite 0.083—0.093 mm long. Siphunculi on

brown cones, bearing 25-30 hairs. Cauda with numerous hairs. Legs brown, pubescent, longer hair on hind tibiae 0.098—0.150 mm long, 1.7-1.8× as long as the diameter at the middle of the tibia ; first tarsal segments with 6. 6. 6 hairs. Forewings with pterostigma bearing a row of long, fine hairs, media once brahched ; hind wings with both oblique.



Alate viviparous female : 136, head ; 137, forewing ; 138, antenna ; 139, ultimate rostral segment ; 140, part of hind leg ; 141, posterior portion of abdomen.

Colour : Not recorded in life.

Measurements in mm :

	Length	Width	Antenna
1.	1.78	0.93	0.76
2.	1.56	0.94	0.79

III	Antennal segments			urs	ht ₂
	IV	V	VI		
0.25	0.09	0.11	(0.11+0.04)	0.14	0.14
0.28	0.11	0.11	(0.13+0.05)	0.14	0.16

(1, ex *Eragrotris nigra*, Kurseong, West Bengal, 16.v.1972 ; 2, ex Grass, Darjeeling, West Bengal, 17.v.1972, C. U. Colls.).

Nymph : (Apterous ; late stage). Body 1.80 mm long, with 1.07 mm as maximum width, pale except antennae, rostrum and legs which are variably brown to dark brown, and covered with numerous hairs. Antennae stout, 6-segmented, pubescent ; hairs on antennae numerous, 0.026—0.066 mm long ; processus terminalis, $0.33 \times$ as long as base of antennal segment VI. Rostrum reaches little beyond hind coxae, ultimate rostral segment dark brown, bearing a number of fine accessory hairs and equal to the second segment of hind tarsus. Dorsal hairs fine, numerous, usually 0.026—0.040 mm long ; 8th tergite with 8 hairs, 0.070—0.083 mm long. Siphunculi on small, densely pubescent cones. Legs stout, hairy ; hairs on femora and tibiae fine, upto 0.060—0.066 mm long, longest one on hind tibiae $0.66 \times$ as long as the width at the middle of the tibia ; empodial hairs fine, as long as claws.

Colour : Pale brown in life.

Measurements in mm.

Length	Width			Antenna	
1.80	1.07			0.62	
III	Antennal segments			urs	ht ₂
	IV	V	VI		
0.15	0.08	0.09	(0.12+0.04)	1.14	0.14

(ex Grass, Ghoom, W.B., 18.v.1972, C.U. Colls.)

Material examined : One alate viviparous femora from Grass, Botanical Garden, Darjeeling, West Bengal, India, 17.v.1972, Coll.

P. K. Pal (Holotype) ; one alate viviparous female from *Eragostris nigra*, Kurseong, West Bengal, India, 16.v.1972, Coll. P. K. Pal ; three apterous viviparous and 2 nymphs from Grass, Ghoom, West Bengal, India. 18.v.1972, Coll. P. K. Pal (Paratypes; C.U. Colls.).

Discussion : This species is close to *corni* (Fab.) but can be separated from *corni* by its long dorsal hairs, more hairs on 7th and 8th tergites and by 6 hairs on first tarsal segment. The species has so far been recorded from *Eragrostris nigra* and unidentified grass where they form small colony during summer months in the hills of Darjeeling area (ca 2000—2500 m) of West Bengal, India. Ants have been noted to attend the species. No primary host is known.

Distribution : INDIA : West Bengal.

Types : In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India.

17. *Anoecia vagans* (Koch) (Fig. 142-144)

- 1856. *Schizoneura vagans* Koch, C. L., *Die Pflanzen Aphiden*, Nurnberg, 8 : 268.
- 1860. *Schizoneura venusta* Passerini G., *Gli Afidi*, Parma, 38.
- 1880. *Schizoneura cerealium* Szanislo, A., *Természetráji Füzetek*, 1880 (4) : 194, 233.
- 1885. *Schizoneura kochii* Lichtenstein, J., *Monog. des. Aphidéens.*, Montpellier, 1885 : 30.
- 1897. *Colopha rozsa* Cholodkovsky, N., *Zool. Anz.*, 20 : 146.
- 1903. *Schizoneura radicola* Mokrzecky, S., *Minst. f. Landwirth u. stutsguter Abt. Landw.*, Ptersburg, 13.
- 1916. *Anoecia viridis* Börner, C., Blunck, E., *Mitt. Kaiserl. & Biol. Anst. Land Forstwirtschaft*, 16 : 36.
- 1957. *Anoecia vagans*, Zwölfer, Helmut, *Z. ang. Ent.*, 40 : 182.
- 1977. *Anoecia vagans*, Pal, P. K., Raychaudhuri D. N., *Orient. Insects*. 11 (3) : 375.
- 1980. *Anoecia vagans*, Heie, Ole H., *Fauna ent. scand.*, 9 : 108.
- 1982. *Anoecia vagans*, Chakrabarti, S., Maity, S. P., Bhattacharya, D. K., *Orient. Insects.*, 16 (1) : 104.

Apterous viviparous female : Body 1.9-2.3 (2.1-2.7 mm) long with 1.28-1.40 mm (1.35-1.95 mm) as maximum width. Head brown :

dorsal cephalic hairs stout with acuminate apices, 0.05-0.07 mm long, upto $2.6-4.0\times$ as long as the basal diameter of antennal segment III. Antennae 6-segmented, dark brown, shorter than half the length of body ; flagellum densely covered with hairs, often with acute apices, scarcely with acuminate apices, longest hair on antennal segment III, 0.06-0.07 mm long, $2.6-4.0\times$ as long as the basal diameter of the segment ; antennal segment III with 0-6, IV with 2-5 (1-3), V with 2-4 (0-1) and base of VI 1-2 (C) protuberant secondary rhinaria, mostly distributed on distal part of the segments and arranged in a row ; processus terminalis upto $0.50\times$ as long as base of antennal segment VI. Rostrum reaches hind coxae, ultimate rostral segment blunt, $0.8-0.9\times$ as long as second segment of hind tarsus and bears 5-7 accessory hairs. Abdominal dorsum sclerotic except in pale intersegmental areas ; 1st-7th tergites each with a large marginal tubercle, in each side ; 7th and 8th tergites each with a transverse sclerotic band ; hairs on the dorsum of abdomen long, stout and dense mostly with spatulate apices, those on anterior tergites and the marginal hairs with incrassate apices, 0.033-0.050 mm long, $1.5-2.0\times$ as long as basal diameter of antennal segment III ; 7th tergite with 4-5 hairs with incrassate apices besides 4 marginal hairs on each side, 0.066-0.073 mm long and 8th tergite with 10 stout hairs with acute apices 0.100-0.109 mm long, these being $2.8-3.2\times$ and $3.3-4.3\times$ as long as the mentioned diameter, respectively. Siphuncular cones with 25-30 flagellate hairs (strong, curved, spatulate hairs, Heie, 1980). Cauda and subgenital plate with long hairs. Legs brown, pubescent, with acute or acuminate hairs, longest one on hind tibiae 0.060 mm long, $0.98\times$ as long as diameter of the middle of the tibia ; dorso-apical hairs fine ; empodial hairs as long as the claws. (Figures in parenthesis from Zwölfer, 1957).

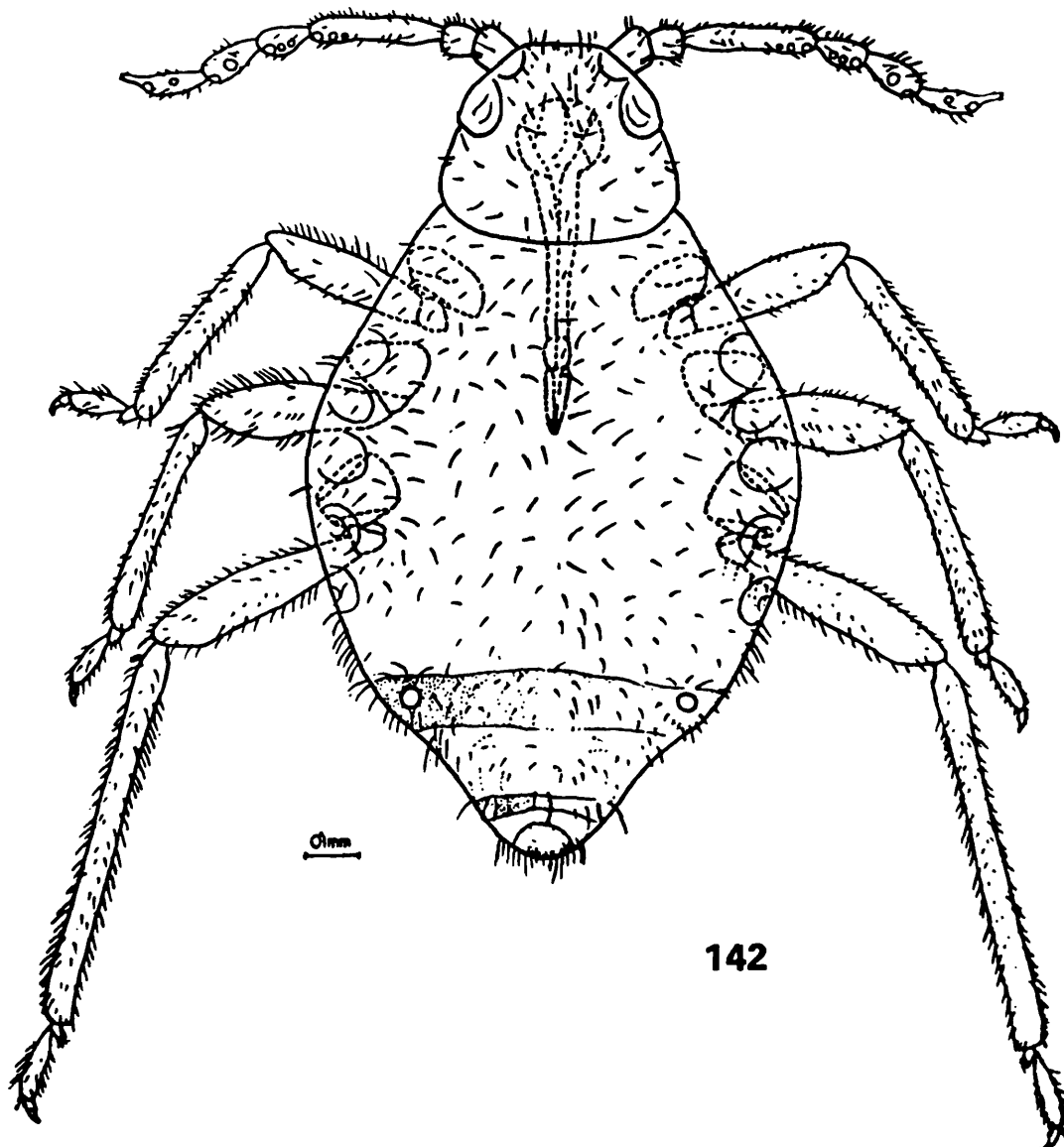
Colour : Greenish pink to chocolate.

Other morphs : Not available, description based on Zwölfer (1957) and Heie (1980).

Apterous fundatrix : Morphological characters similar to those of fundatrix in *A. cornii* but all offsprings become alate viviparous female.

Alate viviparous female (Fundatrigenia) : Body 2.30-2.80 mm long with 1.0-1.15 mm as maximum width. Antenna 6-segmented,

0.83-0.86 mm long, 0.31-0.36× as long as the body ; antennal segment III with 6-10, IV with 1-3, V with 0-2 and VI with 0-1 secondary rhinaria. Abdominal dorsum without dorsal patch on 3rd-6th tergites ; hairs on the dorsum of abdomen 0.007-0.015 mm long, often with spatulate apices.



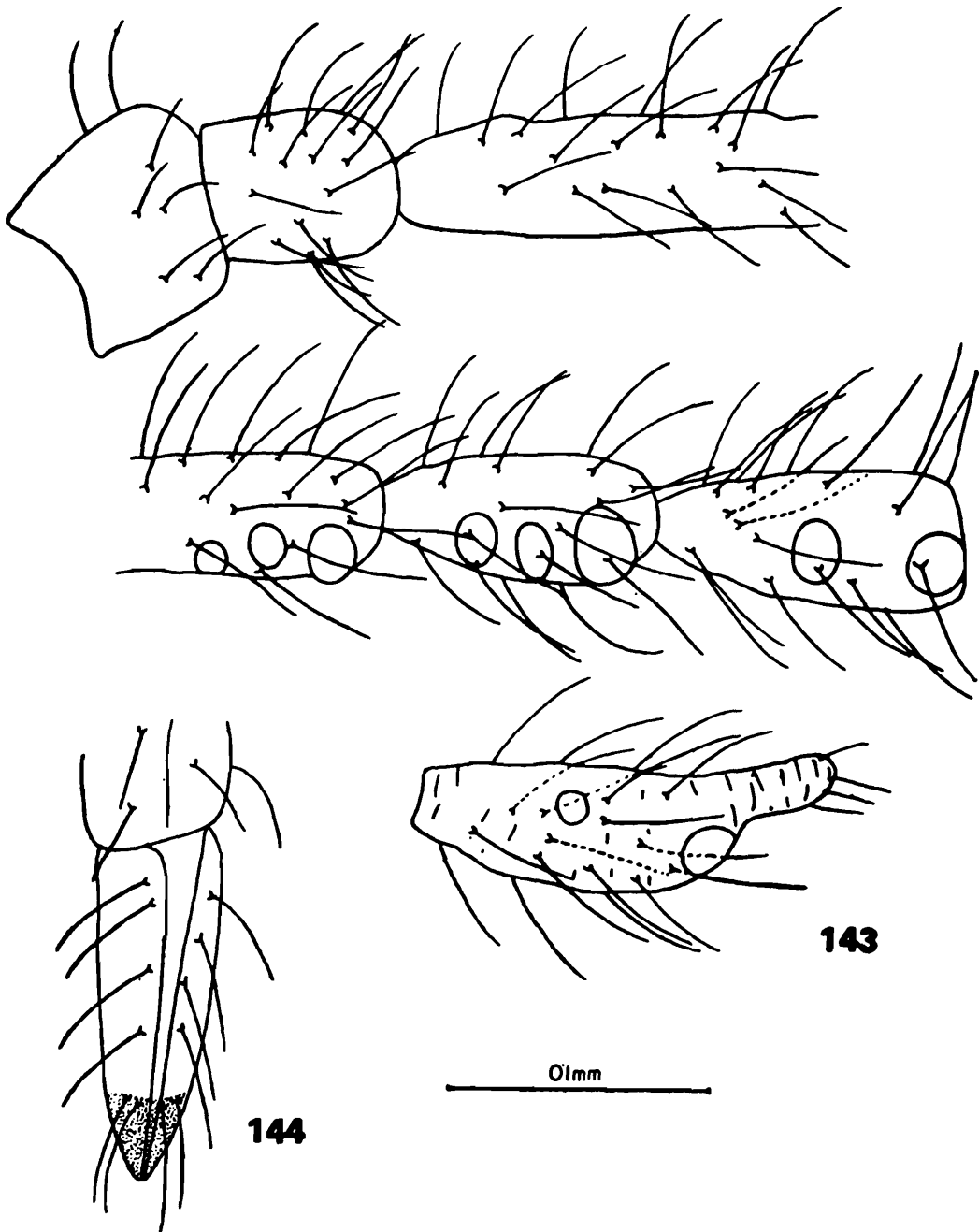
Anoezia vagans Koch. Apterous viviparous female : 142, whole body.

Measurements in mm :

Length	Width	Antennae
2.30	1.00	0.83
2.80	1.15	0.86

III	Antennal segments			Rostrum
	IV	V	VI	
0.26	0.10	0.12	0.16	0.73
0.28	0.13	0.13	0.17	0.81

Alate viviparous female : (Virginopara and Sexupara from secondary host). Body with a black patch on abdomen. Antennae 6-seg.



Apterous viviparous female : 143, antenna ; 144, ultimate rostral segment.

mented, segment III with 6-10 (virginopara) or 10-13 (sexupara), segment IV with 1-3 (virginopara) or 2-4 (sexupara), segment V with 0-2 and VI without any secondary rhinaria. Ultimate rostral segment 0.17 mm long, $0.7-0.8\times$ as long as second segment of hind tarsus. Abdominal tergite 7th only with spatulate hairs.

Measurements in mm :

	Length	Width	Antenna
Virginopara	2.10	1.05	0.86
	2.50	1.40	0.94
Sexupara	2.50	1.15	0.73
	2.90	1.55	1.24

	Antennal segments			Rostrum
III	IV	V	VI	
0.31	0.11	0.11	0.17	0.80
0.35	0.13	0.13	0.18	0.90
0.36	0.12	0.12	0.19	0.83
0.45	0.17	0.17	0.29	0.99

Sexuales : Not available for study.

Larva : Not available for study.

Nymph : (Apterous : late stage).—Body pale with apices of antennae, ultimate rostral segment and tarsi brown, about 1.4 mm long with 0.82 mm as maximum width. Antennae 5-segmented, 0.47 mm long, pubescent ; hairs on flagellum fine, flagellate on segment V and VI, upto 0.033-0.053 mm long and at most equal to the basal diameter of antennal segment III ; processus terminalis $0.33-0.34\times$ as long as base of antennal segment VI. Ultimate rostral segment stout, 0.127 mm long, $0.87\times$ as long as second segment of hind tarsus and bears at least 14 accessory hairs. Dorsal hairs on abdomen with acuminate or expanded apices, upto 0.050-0.060 mm long ; 8th tergite with 8 pairs of hairs, one of such pair being much long

and fine (0.083 mm long) while an other being much shorter (0.050 mm long). Siphunculi on pale hairy cones. Legs stout, thick, pubescent, longest hair on hind tibiae 0.040 mm long, 0.60× as long as the diameter at the middle of the tibia.

Measurements in mm :

Length	Width	Antenna		
1.40	0.82	0.47		
	Antennal segments		urs	ht ₂
III	IV	V		
1.14	0.07	(0.09+0.03)	0.127	0.118

(ex Grass, Pelling, Sikkim, 21.iv.1972, C.U. Colls.).

Material examined : Three apterous viviparous females from Grass, Rimbik, West Sikkim, India, 20.iv.1972, Coll. P. K. Pal ; three apterous viviparous female and one nymph from Grass, Pelling, Sikkim, 21.iv.1972, Coll. P. K. Pal, (C.U. Colls.) ; three apterous viviparous females *Triticum* sp., Hanumanchoti, Uttar Pradesh, India, 13.vi.1980. Coll. D. Bhattacharya (K. U. Colls.).

Discussion : Zwölfer (1957) and Heie (1980), dealing with the biology of the species in Europe, mentioned that it leads holocyclic life cycle alternating between *Cornus sanguinea* and grass roots, as in *corni* but differs from the latter in having only one fundatrigenia generation on *Cornus* ; secondary hosts include barley (*Hordetum sativum*), wheat (*Triticum sativam*) and wild grasses of the genus *Agropyrum* and *Arrhenatherum*. At least three species of ants, *Lasius niger*, *Lasius flavus* and *Myrmica ruginoidis*, have been recorded to attend grass feeding forms. Parasitoids (*Aphidius* sp.) have been noted in two occasions in Germany.

Börner *et al.* (1957) considered *A. vagans* as type of his subgenus *Subanoecia* separating the latter from *Anoecia*, in having fundatrigeniae—alate without dorsal discoidal plate. Börner *et al.* (op. cit) mentioned that larvae of viviparae of *vagans* have spatulate dorsal

setae on 1st-7th tergites, also often on thorax and vertex and that parathenogenetic morphs occur on all types of grain and also on *Eragrostis* and alates occur in great number during August and September and often get caught in cobwebs. In Indian region, only apterae viviparae from grass roots (in Sikkim) and *Triticum vulgar* (in Uttar Pradesh) have been recorded during the months of April-June. Pal (1975) noted heavy infestation on roots at depth of 1 cm-2 cm in dry sandy soil at an altitude of *ca* 2500 mm. The apterae from grass roots in India (Pal and Raychaudhuri, 1977) differ from European specimens of same morph (Heie, 1980), in having secondary rhinaria at the base of segment VI and fine flagellate hairs around siphunculi besides in the greenish pink to chocolate live colour as against yellowish colour.

Distribution : INDIA : Uttar Pradesh ; SIKKIM ; EUROPE ; NORTH AFRICA.

Types : Location of types not known.

Subfamily HORMAPHIDINAE

Body in apterae, may be dorsoventrally flattened, aleuridiform or may be normal. Head in apterae fused with prothorax, often with a pair of horns; other thoracic segments may be fused with first abdominal into a prosoma. Antennae in apterae 2-5-segmented, in alatae 5-segmented ; secondary rhinaria annular. Rostrum short, ultimate rostral segment usually without accessory hairs. Abdominal segments 2-7 in apterae, may be fused, keeping 8th segment free. Siphunculi present as ring or absent. Cauda crescent shaped or variably knobbed. Legs with trochanters usually fused with femora ; in apterae, tarsi may be absent, atrophied, unsegmented or normal, with normal or atrophied claws ; alatae with normal tarsi ; dorsoapical hairs on second tarsal segment capitate or flattened at apices. Wax glands variably developed in apterae and alatae. Alatae may be without any frontal horns or with evident horns. Wing venation reduced ; forewings with media once branched and cubitus and anal fused at base. Sexuales, when known small, apterous and with well developed rostrum ; oviparous female may lay several eggs.

HISTORY

The earliest known genus of the subfamily is *Hormaphis* Osten-Sacken 1861, erected with a single species *hamamelidis* Osten-Sacken 1861, which is actually a synonym of *Brysocrypta hamamelidis* Fitch 1851. The other genus, closest to *Hormaphis*, is *Hamamelistes* and it was described by Shimer in 1867. A total of 15 genera were described under this subfamily, till Baker (1920) studied the aphid genera of the World and treated these aphids under 10 genera, (synonymizing other 5) under 3 tribes and a single subfamily Hormaphidinae. Subsequently, R. Takahashi, while studying the aphids from Formosa, Malaya and Japan described about 15 genera, many remaining monotypic, which together with the earlier known members provided better and more clear evidences to understand the homogeneity of the group. Börner (1930) proposed a revised classification of Aphidoidea under 4 families viz. Aphididae, Eriosomatidae, Adelgidae and Phylloxeridae with 3 subfamilies under Aphididae viz. Lachninae, Aphidinae and Thelaxinae. Hille Ris Lambers (1964) recognised Hormaphidinae as a distinct group being closely connected with Eriosomatinae and Thelaxinae by retaining 3 lensed larval eyes and most of the recent authors consider the group as a distinct subfamily. The nomenclatural aspect of tribal name however have undergone some changes. Three tribes now recognised are Hormaphidini (unchanged from Baker), Nipponaphidini (=Cerataphidini, *partim* of Baker) and Cerataphidini (=Oregmini of Baker). The present knowledge of Hormaphidinae largely resulted from major contributions of van der Goot (1917) on Javan fauna and Takahashi (1931, 1935, 1936, 1939, 1958 a-c 1959, 1962) on Chinese, Malayasian, Sumatran and Japanese fauna.

Hille Ris Lambers (1931, 1953, 1959) has contributed towards the understanding of heteroecious biology of gall forming Hormaphidines : A. K. Ghosh and Raychaudhuri (1973) have given an account of Nipponaphidini except of *Tsugaphis* Takahashi 1967, *Hemipodaphis* David *et al.* Recent account of regional fauna of Hormaphidinae has been provided by Tao (1969) for China and Paik (1965) for Korea ; M. R. Ghosh, Pal, Raychaudhuri (1974) have dealt with Cerataphidine genera from Eastern India except of *Aleurodaphis*, v.d.Goot, *Glyphinaphis*, v.d.Goot and *Doraphis* Hori.

Phylogeny & Distribution

The aphids belonging to “Hormaphidinae” by their annular secondary rhinaria, wax glands on the body, and habit of gall-formation indicate affinity to Pemphiginae and they have often been grouped together under a separate family “Pemphigidae” (Eastop, 1966) but distinctly knobbed cauda (*in some genera like Hormaphis*) and bilobed anal plate indicate their affinity to Drepanosiphinae. However, the aleurodiform apterae, with 3-factted eyes, reduced antennal segments (upto 5), fused trochanters and femora, capitate dorsoapical hairs on second tarsal segment and the reduced wing venation etc. makes the group unique ; the ability to lay number of eggs by female and retention of beak for feeding, by both male and females, also indicate a separate line of evolution.

Fossil record of Hormaphidinae appears to be very scanty. Heie (1972) described a new fossil aphid genus *Electrocornia* only from nymphs, which show horn-like frontal processi, wax-gland arranged in six rows, 5-segmented antennae, fused head and pronotum and small eyes, and apparently without siphunculi ; the monotypic genus with *antigua* as type, perhaps represent the only authentic fossil record, from Batic amber, of Hormaphidinae.

The present knowledge of biology of Hormaphidinae indicates three primary pattern of host association and heteroecous holo-cycles (i) Hamamelidaceae-Fagaceae & others (ii) Hamamelidaceae-Betulaceae (iii) Styracaceae-Graminae.

The absence of heteroecy in many of the present day taxa indicate a secondary adaptation to anholocyclic, (Monophagous/Oligophagous) life cycle but even then, as has been noted under present day host plant association, most of the members remain confined to Magnolidae—Hamamelidaceae—Dilleniaceae line of host plants. Endress (1977) while discussing the evolutionary trend in Hamamelidales—Fagales groups, pointed out many correlated characters (inflorescence and flowers, pollen, fruit, seed and peculiarities of life history) but the most outstanding common trend is the adaptation to wind pollination. Wolfe, Doyle, Page (1976), while studying

a time sequence in pollen types represented in Hamamelidae, observed that Hamamelidales originated at lower Cretaceous, Fagales in Upper Cretaceous and Betulaceae in late Cretaceous. Study of anatomy of wood structure indicate that mostly primarily structured heteroxylous taxa belong to Dillenia-Hamamelidial group and the wood structure of Magnoliales is only partially primitive, Gotwald (1977) has proposed a new phylogenetic model assuming an early separation of angiosperms into at least three branches. All the data cited above, help to understand phylogeny of Hormaphidinae ; the primary hosts of heteroecious species of all these tribes belong to Hamamelidae (2 tribes)—Dilleniidae (1 tribe) and suggest a close-linked group with parallel evolution on those plant groups having an ancestor possibly in the Dillenia-Hamamelidial host. A large number of Nipponaphidine aphids exhibit host on Lauraceae which form a part of Magnoliales and basing on observation of Gottwald (op. cit) this seems quite explainable and indicates a highly selective host association.

The formation of galls on primary hosts and hibernation of individuals on both primary and secondary hosts, indicate a parallelism with Pemphigidae, specially Fordini and Adelgidae. Hormaphidine aphids, by all available information suggest a possible common ancestor with Pemphiginae, evolving as a separate line from ancestor of Aphidoidea, the latter being separated early from ancestor of Adelgidae and Phylloxeridae.

The subfamily now contains 160 species under 38 genera and three tribes (Table I : a large percentage of genera, 19/38, remain monotypic and only 6 genera out of 38 accounts for 105 species out of 160) are restricted in distribution to Eastern and South Eastern Asia. The distribution of host plants largely explains present day distribution of Nipponaphidini ; majority of Hamamelidaceae to which *Distylium* belongs, usually grow in Eastern Himalaya, Chinese, Indo-Malayan region, as also *Quercus*, *Castanopsis*, *Lindera* of *Fagaceae* ; other predominant secondary hosts belong to Lauraceae which usually grow at elevated part of warm countries but a number of Lauraceae like *Cinnamomum*, *Neolitsea* also grow in temperate regions of Eastern Asia ; likewise plants of Moraceae grow in tropics and warm temperate region. As such, the present day distribution of Nipponaphidini remain confined to Sumatra,

Java, Japan, China, Malaya, Thailand and India and Micronesian island.

The tribe Cerataphidini is comprised of 11 genera and 77 species, of which 51 species belong to only two genera viz. *Astegopteryx* Karsch and *Ceratovacuna* Zehntner ; both these genera are widely distributed over Sumatra, Java, Malayasia, Korea, Japan, China and India but some like *Cerataphis* has become circumtropical in distribution, or like *Pseudoregma pannicola* (Takahashi) which has wide distribution over Oriental, Ethiopian, Australian region and in parts of the New World. Primary host plants of Cerataphidine aphids have been identified as *Styrax* on which members of at least three genera form galls (e.g. *Astegopteryx*, *Ceratovacuna*, *Cerataphis*) ; *Styrax* is widely distributed in Tropical and Temperate region except in Africa but none of members of first two Cerataphidine genera is known from areas, besides the one already mentioned ; exclusive association of *Doraphis* on Salicaceae (Dilleniaceae) perhaps also indicate origin of Cerataphidine on Dilleniaceae ; the secondary hosts, belonging to Graminae, Arecaceae, Orchidiaceae, Liliaceae, (all of Liliaceae) are widely distributed over the world but the major association of a number of species with Bamboo-flora perhaps restricted the distribution of Cerataphidini in South east Asia, especially in view of many species becoming anholocyclic and monocious or Bamboo-flora. The genus *Tuberaphis* which infests Visceae and Loranthaceae is often considered as a connecting link between Nipponaphidini and Cerataphidini ; the distribution of sesquiterpene lactones and polyacetylenes described from fatty acids supports a connection between Santalales (which contains Visceae—Loranthaceae) and Magnoliales (Dahlgren, 1977) to which one of the major Nipponaphidine host group, Lauraceae, belongs ; further evidence of Polyacetylenes in some Dilleniaceae, on which most of other Cerataphidine feeds, help to bridge the host-plants and aphids.

The tribe Hormaphidini with only 2 genera and 6 definite species, (as taxonomy of other 6 remain doubtful) is restricted to Holarctic region ; geographical distribution of the primary host *Hamamelis* is a striking example of discontinuous distribution which has been cited by earlier botanists to draw attention to great similarity between the flora of Eastern U.S.A. and of Eastern Asia, parti-

cularly China ; members of both the genera of Hormaphidini alternate between *Hamamelis* (in U.S.A. & Japan) and *Betula* but in other Palaearctic region (Central Europe or Western Europe) they are known only from *Betula*.

The origin of Hormaphidinae as such may be traced back to Cretaceous, when their primary host-plants have also been recorded for the first time ; further, from distribution records, it is evident that most primitive genera of Hamamelidaceae, occur in Japan, Eastern Himalaya, Assam to Sumatra, (*Exbucklandia*), South-China to Sumatra (*Rhodoleia*) and most of the remaining genera also occur in Asia, mainly in the Himalaya in the east and in South East Asia ; in North America, there are only 3 species of *Hamamelis*, the others occurring in China and Japan ; in Central America there are only two species of *Distylium*, other ten species being confined to Himalayas, Assam, continental China, Formosa, Korea and Japan (Takhtajan, 1968) ; similar evidences of numerous Lauraceae and Fagaceae from the subtropical vegetation of any late Cretaceous-tethyan region and Tethyan-teritary region are also available ; primitive species of Betulaceae, belonging to *Alnus* and *Betula* are also confined to Himalayas and East Asia. The origin of Magnolidae-Hamamelidae-Dillinedae during Cretaceous, and the fossil evidences of earliest Hormaphidinae from the same geologic period and the past and present evidences of distribution of primary and many secondary host plants, all perhaps pointed out to the probable origin of Hormaphidinae on Hamamelidae-Dillenedae in East and South East Asia.

Host Plant Association (Table II, III)

Hormaphidinae, as also in case of other aphids, must have been influenced by various eco-biological factors, the host plants amongst which are expected to play a significant role. Host plants, as it is well known, influences the occurrence, distribution, life-cycle, as also morphological development. Several authors (Mordvilko 1928, H.R.L. 1950, Börner 1952, Zwölfer 1958) have regarded host plant relation as the most important amongst the causo-analytical factors having phylogenetic significance.

Definite evidence of host alteration is available in 5 out of 25 genera of Nipponaphidini, members of these alternating between

galls of *Distylium* and leaves of Fagaceae (3), Moraceae (1) and Lauraceae (1). Three other genera *Dinniponaphis*, *Monzennia*, *Quadrartus* and autoecious on *Distylium* and two genera *Tsugaphis* and *Hamipodaphis* are known only from *Tsuga* (Coniferae) and Liliaceae ; rest of the members are largely known from secondary hosts viz. Fagaceae (13) and only two from Lauraceae.

Both genera of the tribe Hormaphidini either have complete holocycle alternating between gall of *Hamamelis* and leaves of *Betula* (in Nearctic region) or remain restricted to *Betula* (in Palaearctic region). At least 3 genera of the Cerataphidini have evidences of host alternation between galls of *Styrax* and leaves of Liliatae ; most members of other genera and many of these three genera, however remain restricted to Liliatae except *Aleurodaphis* v.d. Goot on Compositae and *Doraphis* Hori et Mats, on Salicaceae and *Tuberaphis* Takahashi, on Loranthaceae.

The most characteristic feature which emerges in this respect is that most of the species of Tribe Hormaphidini and Nipponaphidini have evolved on primary hosts belonging to a closely related host plant group i.e. Hamamelidae (*Distylium*, *Hamamelis*) on which they form galls. Gall formation by insects as often been assumed, has resulted only on primary hosts, due to prolonged association with the same and as such Hormaphidinae-Hamamelidae association must have been arisen at an early period (Cretaceous) except in the case of Tribe Cerataphidini, which has Dilleniaceae (Styracaceae or Salicaceae as in *Doraphis* on *Populus*), as primary host ; it may however be pointed out that Dilleniaceae is usually believed to be more recent than Hamamelidae and it has nearly seven times more plant species than the former (3400 and 24,000).

An analysis of secondary hosts of these three tribes also indicate the closer affinity between Nipponaphidini and Hormaphidini than with Cerataphidini ; the most common secondary host of the members of first two tribes being in the same family Hamamelidae (except some on Magaellidae-liliatae etc.) whereas the secondary hosts of last named tribe almost always belong to Graminae of Liliatae ; the process of host finding for Cerataphidine aphids as such appear to have been easier when large number of wide spread species of Liliatae (54,000) are considered. As opposed to gall forming Pem-

phigids, which very often feed on roots of Graminae, the Cerataphidine aphids have however restricted themselves to the leaves of the host-plants (Bamboos' and Grasses and Palms), and most of the species have very close and almost obligatory relationship with bamboo flora in South East and Eastern Asiatic countries.

Monophagism (feeding on species of same genus) could be observed to a great extent in at least 25 species of Nipponaphidini e.g. *Allothoracaphis piyananensis* Tak., *Atarsaphis agrifoliae* (Ferris), *Indonipponaphis tuberculata* A. K. Ghosh & Raychaudhuri, *Lithoaphis lithocarp* (Tak.), *L. shiicola* Tak., *Metanipponaphis cuspidatae* (E & K) *M. rotunda* Takahashi, *M. shiicola* Tak., *Neonipponaphis shiiae* Tak., *Neothoracaphis quercicola* (Tak.), *Nipponaphis machillicola* (Shinji), *N. machilii* (Tak.), *N. manoji*, A. K. Ghosh & Raychaudhuri, *N. (Pseudonipponaphis) himalayan* A. K. Ghosh & Raychaudhuri, *N. (P). machiliphaga* Tak., *N. (P) quercipk* A. K. Ghosh & Raychaudhuri, *Quernaphis tuberculata* Tak., *Reticulaphis distylli* (v.d. Goot) complex, *Schizoneurephis foliarum* v. d. Goot, *Sinnonipponaphis formosana* Tak., *Thoracaphis malayana* Tak., *Thoracaphis rappardi* HRL & Takahashi, *Tsugaphis sorini* Tak., *Xenothorncaphis kashifoliae* Uye. ; most of these monophagous aphids feed on *Quercus*, *Ficus*, *Castanopsis* and often only on one species of the host-plant genus ; at least 3 other species viz. *Dinnonaphis autumn*, *Monzenia globuli* (Monzen), *Quadrartus yashinomiya* Monzen are autoecious and monophagous on primary host, *Distylium racemosum*, Most of the other Nipponaphidine species are oligophagous feeding on related genera of same family.

Monophagism and obligophagism is also widespread in most of the 77 species of Cerataphidini, being restricted to Graminae or Compositae or Salicaceae except in the host alternating hoteroecious species viz., *Astegopteryx styracophila* Karsch, *Ceratovacuna nekoashii* (Sasaki) etc.

Pleophagism, or feeding on related families could be seen in all host alternating aphids of Nipponaphidini and Hormaphidini (Hamamelidaceae—Fagaceae/Hamamelidaceae—Betulaceae).

Polyphagism is rather rare in the subfamily but some species like *Nipponaphis coreanus* (Park), *Astegopteryx styracophila* Kaisch,

and *Ceratovacuna nekeshii* (Sasaki) may exhibit a feeding habit on distantly related families : in the last two species however it is related to heteroecic cycle.

Galls of HORMAPHIDINAE (Figs. 145-147)

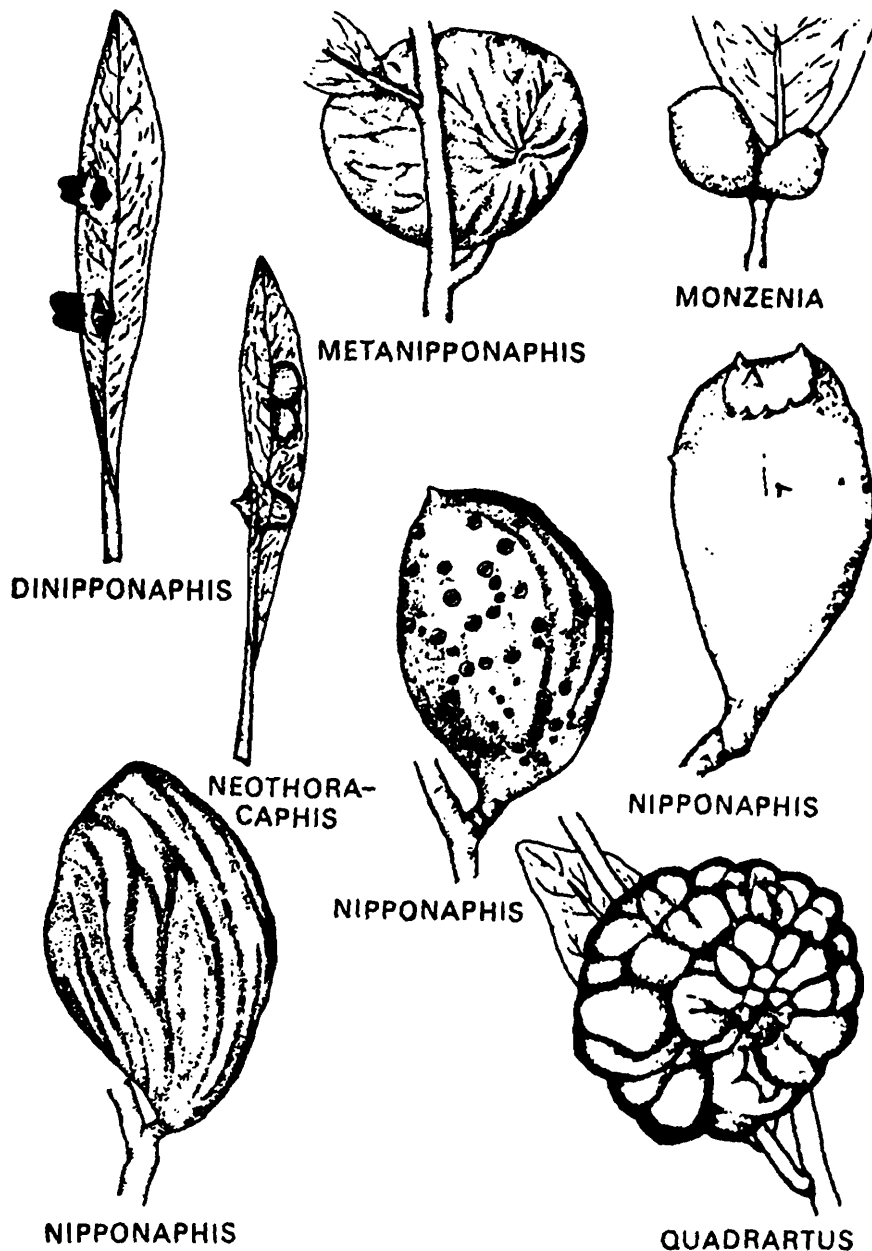
The fact that first generation of heteroecious aphids often form gall on primary host and closed-galls are never observed on secondary host, indicates long association of pest with the host plant. In Hormaphidinae most of the galls are of closed-gall type and pseudogalls are only found in few cases (e.g. on Birch, caused by *Hamamelites spinosus*). The definite primary host association of members of three distinct tribes, as already pointed out, on three different host plant genera viz. Nipponaphidini on *Distylium*, *Hormaphidini* on *Hamamelis* and *Cerataphidini* on *Styrax* exhibit a wide range of shape, size and structural peculiarities of galls.

The galls on *Distylium*, have been studied, for some genera of aphids, by Sorin (1966) and his observations illustrates the variability of shape of galls ; he has also provided data to indicate gradual change of shape and dimension of cells of galled tissue. The change of tissue pattern, resulting in hypertrophy and hyperplasia indicate that sometimes the galls may grow up to 7 times in height within a month ; both adaxial, abaxial epidermis and mesophyll cells increase in cell size. It is interesting to note that mode of feeding of some Nipponaphidine aphids on secondary host e.g. *Quercus* may differ, some passing the stylets intracellularly, other intercellularly ; reason for such differential feeding behaviour, however, can not be definitely correlated with the findings of McAllan and Adams (1961) who have shown that in general, aphids penetrating between cells possess pectinase enzyme while other penetrating thru' the cells lack pectinase (while feeding on leaves).

The galls on *Hamamelis* formed by *Hormaphis* and *Hamamelistis* are so distinct in their mode of origin, and shape etc. that these could easily be used for segregating two genera, e.g. while members of *Hormaphis* produce blister-like leaf gall, 12 mm. in length and 4-5 mm. in diameter at maturity, those of *Hamamelistes* produce galls

on flower buds, 10-30 mm, in length, 10-12 mm. in diameter at maturity, covered with long spine-like structure resembling a *Datura*-seed capsule.

145

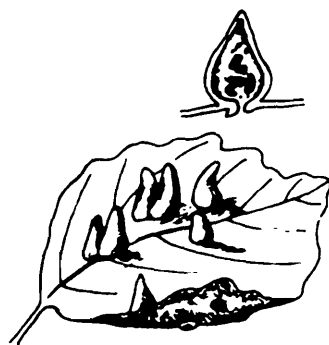


Galls of Hormaphidinae : 145, Galls of some genera of Nipponaphidini.

The galls on *Styrax*, was elaborately described by Doctors van Leeuwens (1926) and Takahashi (1936) has given a key to the aphids of the genus *Astegopteryx* Karsch from *Styrax* gall (which has so far been regarded as the only aphid genus forming galls on *Styrax*,

but later at least some member of *Ceratovacuna*, and in all likeness of *Cerataphis* have become known to form galls on *Sytrax*) of Sumatra and Formosa. Galls on *Styrax* may be large, single or grouped together, formed of modified flower, bud, and apical foliage. Aoki, Yamane and Kiuchi (1977) observed that galls may be filled with twiggy plant tissue and a living gall may be 7 cm. in diameter and may contain as many as 200,000 aphids.

146



HORMAPHIS



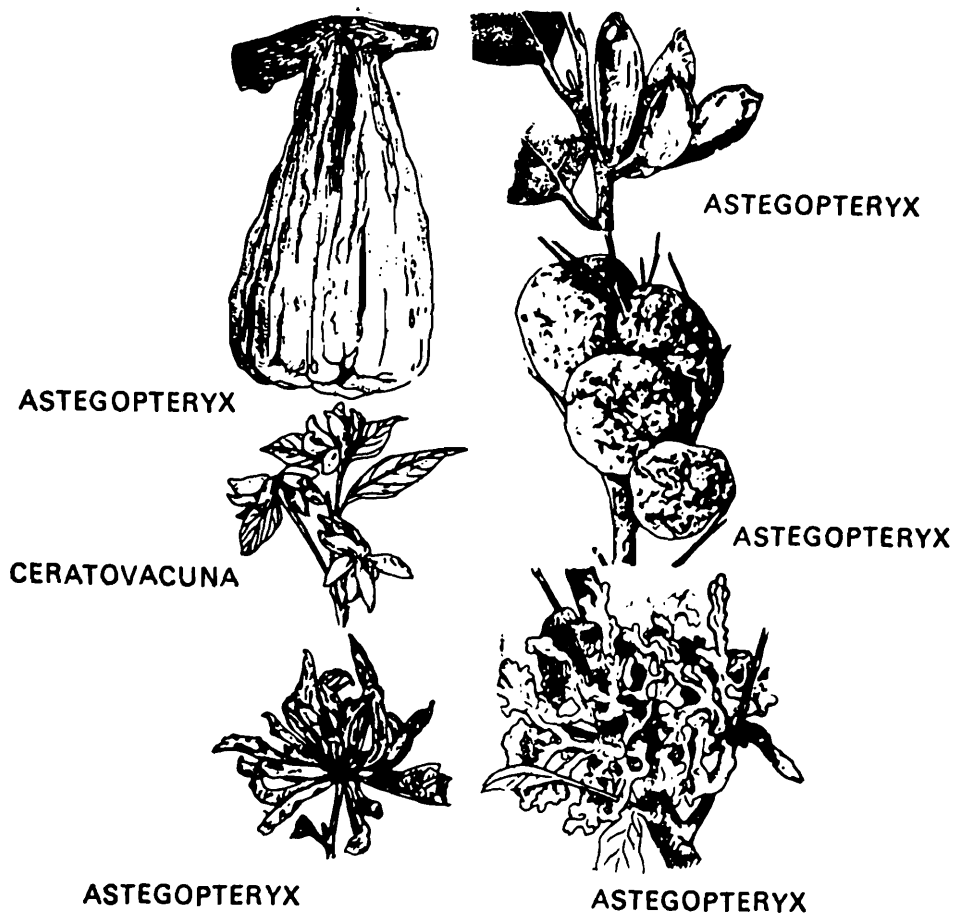
HAMAMELISTES



146, Galls of Homaphidini.

The use of galls in differentiating the taxa up to specific level may not be always possible, as could be noted from Takahashi (1936) that galls of several *Astegopteryx* species may appear similar, but tribal as well as generic separation of Hormaphidinae may be possible on the basis of galls on primary hosts. It would be interesting to investigate the amino-acid pattern of gall forming aphids to further substantiate the taxonomic status of the members, as has been done in separating 5 genera of Adelgiade, (Varty, 1956, Merker, 1958, Eichhorn, 1958).

147



147, Galls of some genera of Cerataphidini.

Discussion

An analysis of classificatory characters/variants amongst genera of each of the tribe show some interesting features. In Nippona-

phidini, none of the 25 genera possess a constant character, although almost all of the genera exhibit a clustre of characters, peculiar to the tribe. Some pairs of characters, however, may show significant correlation, e.g., of the 21 of the genera analysed, 5 genera have either reduced or greatly atrophied tarsi, while others, have more or less normal tarsi ; some characters like absence of siphunculi, absence of posteromesial setae, knobbed cauda, association only with Fagaceous hosts, show strong correlation with this character (i.e. tarsi) and at least in three out of these 5 genera, a trend of reduction in the number of antennal segments could also be seen. Of the genera with normal tarsi, two groups, one with siphunculi and the other without, could be separated and in the second group, (with 5 genera) consolidation of prosoma, absence of posteromesial setae, number of setae on 8th tergite, knobbed cauda etc., could be correlated with the first two characters ; at least two genera, e.g. *Tsugaphis* on *Tsuga* and *Hemipodaphis* on *Liliatae*, exhibit same peculiarity in the consolidation of 8th tergite, and host plant associations. Correlation between the genera without siphunculi and with siphunculi has been discussed under the review of the tribe.

In Hormaphidini, apterae of 3rd generation in both the genera have flat body with wax gland and reduced antennal and tarsal segments, although earlier larvae of 3rd generation on *Betula* show well developed tarsi and antennae ; these morphological changes could be correlated with aleurodifform shape and sedentary habit of the adults.

Almost all the genera under Cerataphidini have frontal horns (except *Aleurodaphis*) in apterae and head and prothorax remain fused ; but fusion of other segments at various degree could be noted in 5 out of 11 genera ; in all these genera, (except in *Chaitoregma*), host association never remains restricted to Graminae and nymphs appear normal as against dimorphis nymphs of some genera without tegmosis. Tegmosis in extreme could be noticed in *Doraphis* on *Populus* and this could be correlated with absence of siphunculi, reduction of antennal segment in the nymph, reduction of tarsi and reduction of wing venation in alatae but, as in other such insects of Hormaphidinae, wax glands never develop and tergum remains papillated.

Wax gland in Hormaphidinae exhibits various degrees of development, both in shape, size, distribution and number of gland cells as also nature of secretion ; the significance of wax glands may be attributed to the need for protection from parasites, and predators (unless predator larvae also possess such glands) and it may be possible that groups with wax glands i.e. Hormaphidini and Cerataphidini evolved earlier and during later period in some genera within these tribe or as in most genera of Nipponaphidini, wax glands become replaced by papillae ; the presence of wax glands in Adelgids on Coniferae, Hormaphidinae on Hamamelidae along with biological habit of gall formation may further suggest the possible evolution of the latter group from 3-lensed Adelgid-like ancestors.

- 1. Frons with a pair of horn-like processii at least in apterae. Siphunculi present, usually pore-like. Media of forewing at least once branched. Apterae may be dorsoventrally flattened and with crenulated lateral margin in some genera. On Graminae (Secondary host) or Compositae, Loranthaceae and Styracaceae.....*Ceratiphidini*

Frons without horn-like processii. Siphunculi pore-like or absent.....2

- 2. Apterae aleyrodiform, with head, thorax and 1st abdominal segment often fused and 2-7 abdominal segments variably fused and reduced ; siphunculi pore-like or absent in apterae. Antennae and legs often atrophied. Alate normal with annular secondary rhinaria ; siphunculi always present ; forewings with media once branched. Usually on Fagaceae, also on Lauraceae and Hamamelidaceae.....*Nipponaphidini*

Body in apterae with wax thread or powder, flat or oval ; siphunculi absent ; antennae 3-segmented. Alatae with 5-segmented antennae and siphunculi ; forewings with media simple. On Betulaceae and Hamamelidaceae.....*Hormaphidini*

Table I. Systematics of HORMAPHIDINAE

Tribe NIPPONAPHIDINI

Genera	Number of species	Distribution
1. <i>Allothoracaphis</i> Takahashi, 1958	1	China, Japan
2. <i>Atarsaphis</i> Takahashi, 1958	1	China, Japan
3. <i>Dermaphis</i> Takahashi, 1958	2	China, Thailand, Japan
4. <i>Dinipponaphis</i> Takahashi, 1962	1	Japan
5. <i>Euthoracaphis</i> Takahashi, 1938	4	India, Japan, U.S.A.
6. <i>Hemipodaphis</i> David et al., 1971	1	India
7. <i>Indonipponaphis</i> A. K. Ghosh & Raychaudhuri, 1973	1	India
8. <i>Lithoaphis</i> Takahashi, 1959	2	Japan
9. <i>Metanipponaphis</i> Takahashi, 1959	7	China, India, Japan
10. <i>Monzenia</i> Takahashi, 1962	1	Japan, Korea
11. <i>Neonipponaphis</i> Takahashi, 1962	1	Japan
12. <i>Neothoracaphis</i> Takahashi, 1958	10	China, India, Thailand, Japan
13. <i>Nipponaphis</i> Pergande, 1906	18	China, India, Thailand, Japan
14. <i>Paranipponaphis</i> Takahashi, 1959	1	Japan
15. <i>Parathoracaphis</i> Takahashi, 1958	6	China, India, Malaya, Thailand, Japan
16. <i>Parathoracaphisella</i> Pramanick, Samanta and Raychaudhuri 1983	1	India
17. <i>Pseudothoracaphis</i> Raychaudhuri, Ghosh and Das 1980	1	India
18. <i>Quadrartus</i> Monzen, 1954	1	Japan
19. <i>Quernaphis</i> Takahashi, 1958	1	China, Japan
20. <i>Reticulaphis</i> Takahashi, 1958	3 + 6	China, India, Thailand, Java, Japan
21. <i>Sinonipponaphis</i> Tao, 1966	3	China
22. <i>Schizoneuraphis</i> v.d. Goot, 1917	3	Java
23. <i>Thoracaphis</i> v.d. Goot, 1917	5	China, India, Java, Malaya, Thailand, Japan
24. <i>Tsugaphis</i> Takahashi, 1967	1	Japan
25. <i>Xenothoracaphis</i> Takahashi, 1958	1	Japan

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26. <i>Hormaphis</i> Osten-Sacken, 1861	4(?)	Holarctic
27. <i>Hamamelistes</i> Shimer, 1867	2(?)	Holarctic

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28. <i>Aleurodaphis</i> v.d. Goot, 1917	4	China, Malaya, India, Japan
29. <i>Astegopteryx</i> Karsch, 1890	38	China, India, Malaya, Thailand, Java, Sumatra, Japan
30. <i>Cerataphis</i> Lichtenstein, 1882	7	China, India, Malaya, Thailand, Japan
31. <i>Ceratovacuna</i> Zehntner, 1887	13	China, India, Thailand, Java, Japan
32. <i>Ceratoglyphina</i> v.d. Goot, 1917	1 + 1	China, India, Malaya, Java
33. <i>Chaitoregma</i> H.R.L. & A. N. Basu, 1966	2 + 1	Malaya, India
34. <i>Doraphis</i> Matsumura & Hori, 1929	1	China, India, Korea, Japan
35. <i>Glyphinaphis</i> v.d. Goot, 1917	1	China, India, Java
36. <i>Pseudoastegopteryx</i> Raychaudhuri et al., 1974	1*	India
37. <i>Pseudoregma</i> Doncaster, 1966	4	China, India, Malaya, Sumatra, Japan
38. <i>Tuberaphis</i> v.d. Goot, 1917	5	India, Malaya, Java

(÷ means sub-species)

(* means type species originally included elsewhere e.g. *Pseudoregma* for 36)

Table II. Host Plant Association of Hormaphidinae Aphid genera and Host Plant families

A. Tribe NIPPONAPHIDINI

<i>Aphid Genera</i>	<i>Host Plant Families</i>
Allothoracaphis	— FAGACEAE
Atarsaphis	— FAGACEAE
Dermaphis	— FAGACEAE
Dinipponaphis	— HAMAMELIDACEAE
Euthoracaphis	— LAURACEAE
	? COMPOSITAE
Hemipodaphis	— ? LILIACEAE
Indonipponaphis	— FAGACEAE
Lithoaphis	— FAGACEAE
Metanipponaphis	— FAGACEAE $\Rightarrow$ HAMAMELIDACEAE
Monzenia	— HAMAMELIDACEAE
Neonipponaphis	— FAGACEAE

Neothoracaphis	— FAGACEAE $\rightleftharpoons$ HAMAMELIDACEAE & only FAGACEAE
Nipponaphis	— FAGACEAE $\rightleftharpoons$ HAMAMELIDACEAE LAURACEAE only FAGACEAE Only CORNACEAE „ MORACEAE „ BERBERIDACEAE
Paranipponaphis	— FAGACEAE
Parathoracaphis	— FAGACEAE
Parathoracaphiseua	— FAGACEAE
Pseudothoracaphis	— FAGACEAE
Quadrartus	— HAMAMELIDACEAE
Quernaphis	— FAGACEAE
Reticulaphis	— MORACEAE $\rightleftharpoons$ HAMAMELIDACEAE or only MORACEAE FAGACEAE
Schizoneuraphis	— LAURACEAE $\rightleftharpoons$ HAMAMELIDACEAE — HAMAMELIDACEAE only FAGACEAE
Sinonipponaphis	— LAURACEAE
Thoracaphis	— FAGACEAE LAURACEAE
Tsugaphis	— CONIFERAE (PINACEAE)
Xenothoracaphis	— FAGACEAE

B. Tribe HORMAPHIDINI

Hormaphis	— HAMAMELIDACEAE $\rightleftharpoons$ BETULACEAE or only BETULACEAE
Hammetistes	— HAMAMELIDACEAE $\rightleftharpoons$ BETULACEAE or only BETULACEAE

C. Tribe CERATAPHIDINI

Aleurodaphis	— COMPOSITAE
Astegopteryx	— GRAMINAE $\rightleftharpoons$ STYRACACEAE only GRAMINAE STYRACACEAE LAURACEAE
Cerataphis	— GRAMINAE/PALMAE/also LILIACEAE & CEYCLANTHACEAE
Ceratovacuna	— GRAMINAE $\rightleftharpoons$ STYRACACEAE only GRAMINAE
Ceratoglyphina	— GRAMINAE
Chaitoregma	— GRAMINAE
Doraphis	— SALICACEAE
Glyphinaphis	— GRAMINAE

Pseudoastegopteryx	— GRAMINAE
Pseudoregma	— GRAMINAE
Tuberaphis	— LORANTHACEAE

Table III. Host Plant Association of HORMAPHIDINAE
Host Plant family and Aphid Genera

CONIFERAE

PINACEAE : *Tsuga* (*Tsugaphis*)

MAGNOLIDAE

LAURACEAE : *Cinnamomum* (*Nipponaphis*, *Euthoracaphis*) *Lindera* (*Thoracaphis*)
Litsaea (*Nipponaphis*, *Metanipponaphis*, *Schozoneuraphis*) *Machilus* (*Nipponaphis*, *Sinonipponaphis*)
Umbellularia (*Eutheracaphis*)

BERBERIDACEAE : *Holboellia* (*Nipponaphis*)

HAMAMELIDAE

HAMAMELIDIACEAE : *Hamamelis* (*Hormaphis*, *Hamamelistes*)
Distylium (*Nipponaphis*, *Dinnipponaphis*, *Metanipponaphis*, *Monzenia*, *Neothoracaphis*, *Quadrartus*, *Reticulaphis*, *Schizoneuraphis*)

MORACEAE : *Ficus* (*Nipponiaphis*, *Reticulaphis*)

FAGACEAE : *Castanopsis* (*Lithoaphis*, *Metanipponaphis*, *Neonipponaphis*, *Nipponaphis*, *Reticulaphis*)
Lithocarpus (*Neothoracaphis*, *Thoracaphis*,) *Parathoracaphis*) *Quercus* (*Allothoracaphis*, *Dermaphis*, *Neothoracaphis*, *Nipponaphis*, *Parathoreaphis*, *Parathoracaphisella*, *Pseudothoracaphis*, *Indonioponaphis*, *Xenothoracaphis*, *Atarsaphis*, *Quernaphis*)

BETULACEAE : *Betula* (*Hormaphis*, *Hamamelis*)

DILLENIDAE

SALICEAE : *Populus* (*Doraphis*)

ERICACEAE : *Pieris* (*Thoracaphis*)

STYRACACEAE : *Styrax* (*Astegopteryx*, *Ceratovacuna*, *Cerataphis*)

ROSIDAE

CORNACEAE : *Aucuba* (*Nipponaphis*)

BALSAMINACEAE : *Impatiens* (? *Aleurodaphis*)

ASTERIDAE

COMPOSITAE	: <i>Blumea</i> <i>Gymnaster</i> <i>Kalimeris</i> <i>Ligularia</i>	} <i>Aleurodaphis</i>

LILIATAE : (= *Monocotyledons*)

GRAMINAE	: <i>Arundinaria</i>	} (<i>Astegopteryx</i> , <i>Ceratoglyphina</i> , <i>Ceratovacuna</i> , <i>Chaitoregma</i> , <i>Glyphinaphis</i> , (<i>Pseudoregma</i>) (<i>Ceratovacuna</i>) („) („) (<i>Pseudoregma</i>) (<i>Ceratovacuna</i>) („) (<i>Hamipodaphis</i>)
BAMBUSAE	: <i>Bambusa</i>	
	<i>Dendrocalamus</i>	
	<i>Miscanthus</i>	
	<i>Microstigum</i>	
	<i>Oplismenus</i>	
	<i>Panicum</i>	
	<i>Saccharum</i>	
	<i>Zingiberaceae</i>	
	<i>Liliaceae</i>	

ARACEAE	: <i>Arceuthobium</i> <i>Coccophagus</i>	} (<i>Cerataphis</i>)

ORCHIDIACEAE : (*Cerataphis*)

Tribe NIPPONAPHIDINI

All, but one species, viz., *Euthoracaphis umbellulariae* (Essig), of the tribe, are known from South east Asia ; at least 11 species are known to produce galls on *Distylium* and 5 of these have a secondary host on Fagaceae and Moraceae. Rest of the species usually produce parthenogenetic morphs on secondary hosts ; at least 10 genera are known only from apterous exules, 3 only from alate forms which are autoecious on *Distylium*, while 10 other genera are known from both apterae and alatae. However, not all of the last group of species are known by both alate and apterous morphs. The primitive biology, it is assumed, must have involved alternation between *Distylium* and other secondary hosts and most species have become secondarily restricted only to the latter host group.

Some genera need special mention, *Hemipodaphis*, an Indian genus (from Liliatae in Darjeeling district, India) shows a nodular dorsum, circular pit-like wax plate on head, thorax and abdomen, atrophied tarsi, a thick black marginal sheath posterior to 6th tergite and appears very distinctive. Similarly, *Tsugaphis*, a Japanese genus from *Tsuga*, show tegmosis of body segments and a complete consolidation of 8th tergite with rest of the abdominal segments ; both the genera are known by a single species and only by exules.

In general, Nipponaphidine genera appear to be a closely evolved group and the taxonomy is largely based on the apterae i.e. on the nature of tergum (papillated, reticulated), marginal setae on prosoma (minute/long, sparse/numerous) prosomal division or fusion of tergites, number of antennal segments (1-4), number of hairs on 8th tergite and number of postero-mesial setae, development of tarsus (atrophied/reduced/normal), presence or absence of siphunculus, shape of cauda (knobbed/globular) and host plant association (Table IV). Some correlation between these morphological variants may be observed : (a) In all genera e.g. *Allothoracaphis*, *Dermaphis*, *Midrothoracaphis*, *Neothoracaphis*, *Paranipponaphis*, *Parathoracaphis*, *Quernaphis*) without siphuntuli, prosoma is consolidated and postero-mesial setae remain absent and almost all of these genera are associated with *Quercus*, except *Reticulaphis* which is associated with *Castanopsis* and *Ficus* (and *Distylium* as primary host) ; at least half of these genera exhibit reduced tarsi and most of these genera

have depressed body ; (b) On the other hand, the genera with siphunculi have either divided or consolidated prosona, posteromesial setae present or absent and are associated with a number of plant genera (*Quercus*, *Castanopsis*, *Cinnamomum*, *Hitsaea*, *Machilus*, *Ficus*, *Viscus* etc.).

However, reduction of certain characters may not be always indicative of inter-relationship of genera within the tribe. The tribe appears unique in combining the genera with peculiar morphology, specific host association, adaptive features for bark-inhabitation etc. The loss of primary host does not appear to have stopped the continuous evolution on hosts which are considered secondary. For example, several forms from the same host plant may be available which appear very close e.g. *Reticulaphis distylii* van der Goot which alternate between *Distylium stellarae* and *Ficus* spp. have 5 different forms (all from Java) differing in length and shape of marginal hairs on *Ficus* ; whether these are subspecies or clones is debatable but it indicates the possible segregation into distinct species on the secondary hosts.

In the region under study, a total of 21 species under 12 genera are known, of which 15 species and 4 genera are endemic in origin. All the species of Nipponaphidini are recorded only from Northern India, but mostly from northwestern region. The host-plant families include Berberidaceae, Ericaceae, Fagaceae and Lauraceae ; only 6 species out of 21 are known both by apterae and alate, while rest are known only from apterous exules.

Key to the genera

1. Siphunculi present. Prosoma never completely fused with abdominal segments (2-7), separated at least laterally or completely from latter ; rhinaria either closely placed or wide apart.....2
- Siphunculi absent.....7
2. 8th abdominal tergite always with 2 hairs. Abdominal segments (2-7) with 6 pairs of hairs ; Posteromesial hairs on 7th tergite absent. Dorsal pustules on prosoma appear doubleri mmed. Antennae reduced ; rhinaria

closely placed. On Fagaceae and Hamamelidaceae.....*Metanipponaphis* Takahashi

8th tergite usually with 4-8 hairs, if sometimes with 2 hairs, then pustules never double rimmed. Cauda broader than long and appears semioval.....3

3. Abdominal segments (2-7) separated from prosoma and with numerous additional fine, short to long hairs, besides submarginal ones. Dorsum of prosoma with indistinct mosaic-like sculptures or pustules and at full maturity divided by distinct sutures into a large median quadrangular area and an anterior and two lateral areas. 8th tergite with 2-4 hairs. On Lauraceae and Compositae.....*Euthoracaphis* Takahashi

Abdominal segments (2-7), sometimes only laterally separated from prosoma and without any additional fine hairs. Prosoma without any additional fine hairs, or if present, always mixed with thick, long ones.....4

4. Dorsum of prosoma with distinct spinal and lateral finger-like tubercles besides low rounded pustules. Posteromesial hairs on prosoma and abdominal segment 7 absent. 8th tergite with 4 hairs. On Fagaceae.....*Indonipponaphis* Ghosh & Raychaudhuri

Prosoma variably pustulate dorsally, without any finger-like tubercles. Hairs on dorsum of prosoma fine, if thick and stout, never hollow or arise from conspicuous bases. Posteromesial hairs on prosoma may be present or absent.....5

5. Tergum smooth but bearing pointed triangular spine-like pustules. Abdominal segments (2-7) with 6 pairs of long submarginal hairs and a pair of posteromesial hairs on 7th tergite. Prosoma consolidated with fused abdominal segments, at least partly. On Fagaceae, Hamamelidaceae, Lauraceae.....*Sinonipponaphis* Tao

Tergum never with tringular spine-like pustules. Other characters variable.....6

6. Abdominal segments (2-7) with 6 pairs of submarginal hairs but without any posteromesial hairs at hind end ; 8th tergite with 2-4 hairs. Prosoma and abdominal segments (2-7) indistinctly separated or well defined. On Fagaceae, Hamamelidaceae, Lauraceae, Ericaceae etc.....*Thoracaphis* van der Goot

Abdominal segments (2-7) always with a pair of posteromesial hairs at hind end besides 6 pairs of submarginal hairs and sometimes also with submedian hairs ; 8th tergite with 4-8 hairs. Prosoma and abdominal segments (2-7) usually faintly to distinctly defined both laterally and dorsally, but sometimes separated only along lateral margins.....*Nipponaphis* Pergande

- a. (b) Prosoma without paired posteromesial hairs at hind end. Dorsal hairs thick and stout and arising from low tubercles, 8th tergite with 4 hairs. On Lauraceae.....Subgen. *Pseudonipponaphis*
Ghosh & Raychaudhuri

- b. (a) Prosoma with a pair of posteromesial hairs at hind end. Dorsal hairs usually not stout but fine and not arising from tubercular bases. 8th tergite with 4-8 hairs. On Berberidaceae, Fagaceae, Hamamelidaceae, Lauraceae.....Subgen. *Nipponaphis*
Pergande

7. Prosoma consolidated with abdominal segments (2-7). Dorsum reticulated ; submarginal hairs thick, and spine-like. 8th tergite with 2-4 stout spine-like hairs. Tarsi usually 2-segmented and with small, rudimentary claws. On Fagaceae.....*Parathoracaphis* Takahashi

Prosoma never consolidated with abdominal segments (2-7).....8

8. Dorsum covered with hemispherical nodules. Wax plates circular, pitted, each with 3-6 faces, variably present on head, thorax and abdomen. Trochanters fused with femora ; tarsi rudimentary ; claws large, normal. On indet plant, ? Liliaceae.....*Hemipodaphis* David,
Narayanan & Rajasingh

Dorsum never with nodules. Wax glands never as above.....9

9. Legs with normal tarsi of 2 segments and with claws. Submarginal hairs on prosoma may be absent or present.....10
- Either all legs with rudimentary tarsi or only hind legs with such tarsi and other legs without tarsi. Submarginal hairs present on prosoma.....11
10. Submarginal hairs absent on prosoma. Dorsum corrugated. Antennae 3-segmented. 8th tergite with 2 hairs. On Fagaceae.....*Pseudothoracaphis* Raychaudhuri, Ghosh & Das
- Submarginal hairs absent but margin appear crenulated on prosoma. Dorsum smooth. Antennae hardly discernible, 2-segmented. On Fagaceae.....*Parathoracaphisella* Pramanik, Samanta & Raychaudhuri
11. Fore- and mid-legs without tarsi, hind legs with rudimentary tarsi. Antennae placed ventrally, unsegmented. Prosoma without mid-dorsal hairs and with irregular mosaic-like sculpture. Abdomen with round plate-like structure, without submarginal hairs.....*Neothoracaphis* Takahashi
- All legs with rudimentary tarsi (1-segmented). Prosoma reticulated on dorsum, without papillae, mid-dorsal region of prosoma with minute hairs discernible only by pits. Submarginal hairs on abdominal segments (2-7) minute; 8th tergite with 2-4 hairs. Tarsal claws rudimentary or atrophied. On Fagaceae and Moraceae.....*Reticulaphis* Takahashi

Genus 4. *Euthoracaphis* Takahashi, 1938

1938. *Euthoracaphis* Takahashi, R., *Tenthredo* 2 : 14 (as a subgenus of *Thoracaphis*) ; Takahashi, R. 1959. *Bull. Univ. Osaka Prof. B.* 9 : 8 ; Ghosh, A. K., and Raychaudhuri, D. N., 1973. *Kontyu*, 41 (2) : 156 ; Raychaudhuri, D. N., Ghosh, M. R., Pal, P. K., Ghosh, A. K. 1980. In *Aphids of North East India and Bhutan*, 373.

Type species : *Thoracaphis umbellulariae* Essing.

Morphology : Body depressed, subcircular, brown to dark brown. Apterae with head, thorax and abdominal segment 1 fused

together and divided into an anterior large median and two lateral areas by sutures ; abdominal segments 2-7 fused and distinctly separated from prosoma and 8th segment. Antennae in apterae 3-segmented and very short ; primary rhinaria small, round, ciliated, placed wide apart at the apex of terminal segment ; antennae in alatae 5-segmented, with annular secondary rhinaria on all segments of the flagellum. Eyes of 3 facets in apterae, normal in alatae. Rostrum hardly extends beyond fore coxae ; ultimate rostral segment always longer than second segment of hind tarsus and without any accessory hairs. Dorsum in apterae variably wrinkled or sculptured or pustulate ; dorsal hairs long, fine, sparse or numerous, arranged in paired submarginal row on the abdominal segments 2-7, besides few submedian and posteromesial setae ; 8th tergite with 2-4 hairs ; abdominal dorsum in alatae pale. Siphunculi small, pore-like, often surrounded by some annular striations. Cauda constricted at base and distinctly knobbed, bearing many hairs. Subanal plate bilobed each lobe bearing many fine hairs. Legs pale, stout ; tibial setae long and fine ; tarsi of two segments, claws normal ; first tarsal segments with 3,3,2 or 3.3.3 hairs ; dorso-apical hairs on second tarsal segments expanded at species. Forewings with pterostigma little dusky, wing veins sometime distinctly bordered brown, media once branched ; hind wings with both obliques.

Sexual forms : Not known.

Discussion : Takahashi (1938) proposed the name *Euthoracaphis* as a subgenus of *Thoracaphis* van der Goot with *Thoracaphis umbellulariae* Essig described from U.S.A., as the type species, basing on the characteristic division of prosoma into a large median area and two lateral areas. Subsequently, Takahashi (1959) proposed *Euthoracaphis* as a distinct genus, and considered *Thoracaphis cinnamoniae* Shinji, 1941 as a synonym of Californian *umbellulariae* (Essig). Hille Ris Lambers (1966) noted that number of dorsal hairs in all apterae collected in California is about twice as in the apterae from Japan and while agreeing in congeneric status of *umbellulariae* and *cinnamoniae* considered these as two distinct species. Two more species described from North East India by Ghosh, A. K. and Raychaudhuri (1973), now makes a total of four species known under this typically eastern Asian genus of aphids.

Table IV. Character Variants

Tribe NIPPONAPHIDINI

	Tarsus	Siphunculus	Prosoma	Post-mesial setae	Setae on 8th	Body	Tergum	Marginal setae	Cauda	Ant segment	Host Plants
	1	2	3	4	5	6	7	8	9	10	11
Nipponaphis	n	p	c	p	4	n	p	1—2	k	3, 4 ; 2	Cinnanomum, Quercus Ficus, Litiaca Holboellia, Aucuba Castanopsis
Neonipponaphis	n	p	c	p	4—6	n	p	1—n	k	3 ; 2	Castanopsis
Schizoneuraphis	n	p	c	a	4	n	p	1—s	?	3 ; 2	Ficus
Metanipponaphis	n	p	c	a	2	n	p	m—s	k	2, 3 ; 2	Castanopsis, Lithocarpus Quercus, Litsaea
Thoracaphis	n	p	c	a	2—4	n	p	1—s	k	3 ; 1, 2	Lindera, Lithocarpus Quercus, Chinna
Nuthoracaphis	n	p	d	a	2	n	p	1—n	k	3 ; 2	Cinnanomum, Senecio
Xenothoracaphis	n	p	c	a	4	d	s	1—s	g	3 ; 1	Quercus
Indonipphaphis	n	p	d	a	4	n	p	tuberculate	k	3 ; 2	Quercus
Lithoaphis	n	p	c	p	4	n	s, m	m—s	k	2, 3 ; 2	Castanopsis
Allothoracaphis	n	p	c	a	4	d	m	1—s	k	3 ; 2	Quercus
Parathoracaphis	n	a	c	a	4	d	r	1—s	k	2 ; 1	Quercus, Lithocarpus
Parathoracaphisella	n	a	c	a	2	n	r	absent	k	2 ; 1	Quercus
Paranipponaphis	n	a	c	a	4	n	m, p	m—s	k	3 ; 2	Quercus
Pseudothoracaphis	n	a	c	a	2	n	corrugated	absent	k	3 ; ?	Quercus
Tsugaphis	n	a	c	?	?	d	corrugated	m—s	g	4 ; 1	Tsuga
Dermaphis	r	a	c	a	4	d	m	1—s	k	3 ; 2	Quercus
Reticulaphis	r	a	c	a	2	d	r	1—s	k	1, 2, 3 ; 2	Castanopsis, Ficus
Quernaphis	r	a	c	a	2	n	p	1—s	k	3 ; 1	Quercus
Neothoracaphis (& Microthoracaphis, Microungus)	r-a-n	a	c	a	4	d	m, s, c—r	m—s or absent	k	1 ; ?	Quercus, Lithocarpus
Atarsaphis	a	a	d	a	4	n	p, m	m—s	k	1 ; 0	Quercus
Hemipodaphis	n	a	d	?	2	n	p	1—s	k	3 ; 2	Liliatae ?

Abbreviation used : Col. 1 :— Tarsus, normal (n), reduced (r), atrophied (a)

Col. 2 :— Siphunculus present (p), absent (a)

Col. 3 :— Prosoma divided (d), fused (c)

Col. 4 :— Setae on 7th present (p), absent (a)

Col. 5 :— Setae in 8th tergite—Number of

Col. 6 :— Body normal (n) or depressed (d)

Col. 7 :— Tergum smooth (s), papillated (p), mosaic (m),

reticulated (r), Corrugated (c), tuberculate (tu)

Col. 8 :— Setae long (l), minute (m), sparse (s)
numerous (n)

Col. 9 :— knobbed (k), globular (g)

Col. 10 :— number of segments ; number of rhinaria or
last segment

Col. 11 :— Host plants

Table V. Character Variants

Tribe CERATAPHIDINI

	Frontal Horn 1	Fusion of Segs. 2	Siphunculi/ hair 3	Ant segments 4	Wax gland 5	F.T.C. 6	Wing venation 7	Nymph 8	Host Plant 9
Astegopteryx	p	H + P—M _g —Mt—A 1—8	p(h)	5—5	m	3,3,2/3,2,2	n	±D(s)	Styracaceae
Ceratovacuna	p	H + P—M _g —Mt—A 1—8	p	4/5—5	±s—p—m	4, 3, 2 3, 3, 2 3, 2, 2	n	±D(s)	Graminae „
Ceratoglyphina	p	H + P—M _g —Mt—A 1—8	p	4—5	a	4, 3, 2	n	n	Graminae
Glyphinaphis	p	H + P—M _g —Mt—A 1—8	p	4—?	a	4, 4, 2	n	n	Graminae
Pseudoastegopteryx	p	H + P—M _g —Mt—A 1—8	p	4—5	a	4, 4, 2	n	n	Graminae
Pseudoregma	p	H + P—M _g —Mt—A 1—8	p	4—5	s, m ; po	4, 4, 2 4, 3, 2 3, 3, 2 3, 2, 2 2, 2, 2	n	n(p) D(p)	Graminae
Chaitoregma	p	H + P—M _g —Mt—A 1—8 A2 + 7—A8	p	4—?	po	3, 3, 3 3, 3, 2	?	n	Graminae
Aleurodaphis	a	H + P—M _g —Mt—A 1 + 7 —A—8	p	5—5	±p—m	3, 2, 2 2, 2, 2	n	n	Compositae
Tuberaphis	p	H + P—M _g —Mt—A 1 + 7 —A—8	p	5—5	m	2, 2, 2	n	n	Loranthaceae Viscaceae
Cerataphis	p	H + P + M _g + Mt—A 1—8	p	4—5—5	m	4, 4, 2 4, 3, 2 3, 2, 2	n	n	Graminae Styracaceae Orchidaceae Palimae
Doraphis	p	H + P + M _g + Mt + A 1—7 —A—8	a	2—4	pa	T.r	Med—S H.W—lob	n	Salicaceae

Abbreviation :

Col. 1 :— a= absent, p= present

Col. 2 :— H= Head, P= Prothorax, M_g= Mesothorax, Mt= Metathorax,
A 1—8= adb. segments 1—8

Col. 3 :— h= hair

Col. 4 :— apt= apterae, al= alate

Col. 5 :— S= spiral, p= pleural, m= marginal, pa= papillate, po= only
wax pores

Col. 6 :— F.T.C.= First tarsal chaetotaxy ; Tr= Tarsi reduced

Col. 7 :— n= normal (i.e. media with one branch, Hindwing with 2 obliques),
Med—S, media single branched, Hw—Idb= Hind wing with only
one obliqueCol. 8 :— D=Dimorphic with soldier form ; ±D (s) means, some species
with soldiers, D (p) means, some nymph pseudoscorpion-like ;
n=normal

Biology : The members of the genus infest plants of Lauraceae, viz. *Cinnamomum camphora*, *C. japonicum*, *C. paniculatum*, *Umbellularia californica* but one of the species from northeastern India is reported from Compositae, *Senecio* (*E. longisetosa*). In California, infestation may be heavy on *Umbellularia* making the tree look sooty black but the infestation in north eastern India appear moderate and mostly recorded during the months of December to May specially in areas of higher altitude. So far, only viviparae, which appear to be monoecious, are known.

Distribution : India ; Japan ; U.S.A.

Type species.—*Thoracaphis umbellariae* Essig 1932, deposited in Essig collections, Department of Entomology, University of California, Berkeley, U.S.A.

Key to the species of *Euthoracaphis*.

Apterous viviparous females :

Dorsum of prosoma with long and short fine hairs mixed with long thick hairs, longest ones of the fine hairs upto $0.50-0.70 \times$ as long as the antennae, thick hairs equal to or longer than length of antennae. 8th tergite with 4 hairs..... *E. heterotricha* A. K. Ghosh & Raychaudhuri

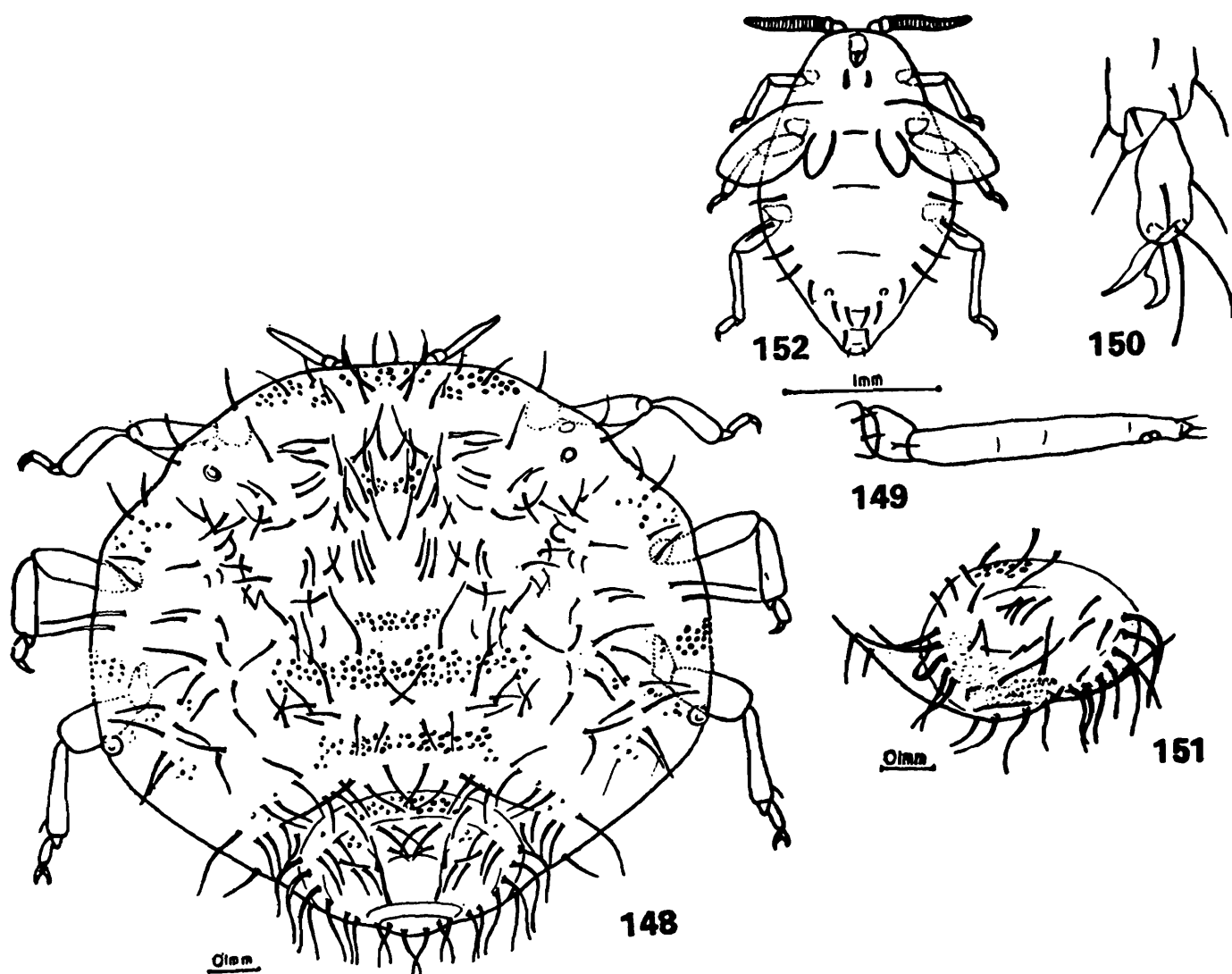
Dorsum of prosoma with only long fine hairs, hardly as long as length of antennae. Prosoma with indistinct but protuberant semioval pustules. 8th tergite with 2 hairs..... *E. longisetosa* A. K. Ghosh & Raychaudhuri

18. *Euthoracaphis heterotricha* Ghosh & Raychaudhuri (Figs. 148-157)

1973. *Euthoracaphis heterotricha* Ghosh, A. K., and Raychaudhuri, D. N., *Kontyu*, 4 (2) : 156.
1976. *Euthoracaphis heterotricha*, Eastop, V. F. and Hille Ris Lambers, D., *Survey of the World's Aphids*, 197.
1980. *Euthoracaphis heterotricha*, Raychaudhuri, D. N., Ghosh, M. R., Pal, P. K., Ghosh, A. K., In *Aphids of North East India and Bhutan*, 374.

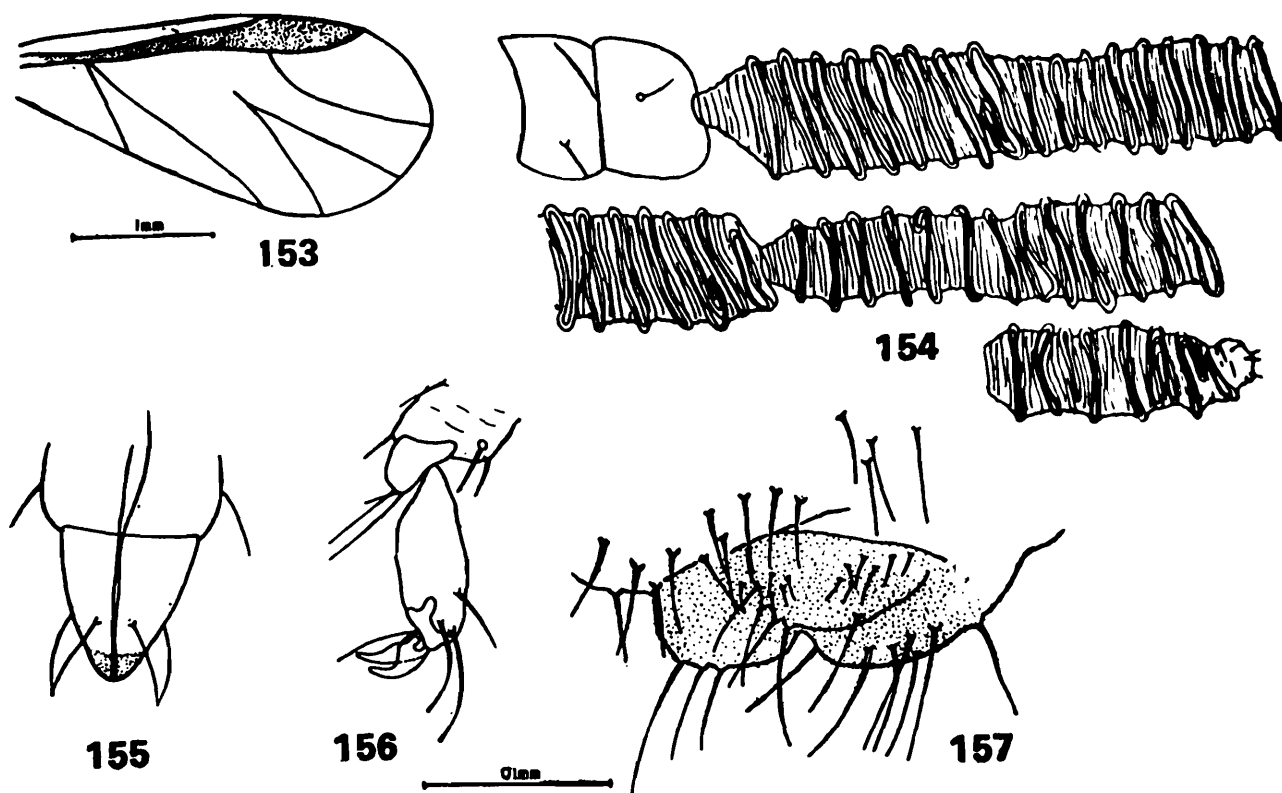
Apterous viviparous female : Body semioval, thickened, dark brown and pubescent. Antennae short, indistinctly 3-segmented ;

segment III nearly smooth, about $0.70 \times$ as long as hind tibia, bearing 2 rhinaria, placed wide apart. Ultimate rostral segment $1.4 \times$ as long as second segment of hind tarsus. Dorsum of prosoma divided by sutures into a median, an anterior and two lateral areas, bearing scattered or localised groups of indistinct papillae and numerous hairs which are either fine and of variable lengths or thick and long, fine hairs being distributed over middorsum and on perpendicular areas, $0.50-0.70 \times$ as long as the antennae ; thick hairs on mid-dorsal region, arranged on each side in four groups, of which 2nd and 3rd are duplicated and the rest remain single making a total of 6 on each side and these being always equal to or longer than the length of



Euthoracaphis heterotricha A.K. Ghosh & Raychaudhuri. Apterous viviparous female : 148, whole body. Apterous viviparous female : 149, Antenna ; 150 ultimate rostral segment ; 151, caudal region. Alate nymph : 152, whole body.

antennae. Abdominal segments 2-7 completely separated from prosoma, with a few submedian hairs besides 6 pairs of long and thick submarginal hairs of similar length and a pair of similar posteromesial hairs on 7th tergite ; 8th tergite with 4 long hairs of which inner ones are longer than the others and equal to the length of antennae. Siphunculi pore-like surrounded by annular wrinkles. Cauda semioval hardly twice as long as broad and bears 10 hairs. Subanal plate divided, each lobe bearing a number of long fine hairs. Legs pale ; hairs on tibiae fine, longer than the width at the middle of the tibia ; tarsi two-segmented, claws normal ; first tarsal segment with 3, 3, 2 hairs.



Alate viviparous female : 153, forewing ; 154, antenna ; 155, ultimate rostral segment ; 156, second segment of hind tarsus ; 157, caudal region.

Colour : Dark brown in life.

Measurements in mm :

	Length	Width	Antennae
1.	?	?	0.12
2.	?	?	0.11

I	Antennal segments		urs	ht ₂
	II	III		
0.02	0.03	0.07	0.06	0.04
0.02	0.03	0.06	0.06	0.04

(1, 2 ex unidentified host, Lamahat, West Bengal, 3.v.1970 ; C.U. colls).

Alate viviparous female : Body 1.6-1.7 mm long with 0.68-0.70 mm as maximum width at the middle of abdomen. Head dark brown, dorsal cephalic hairs 10-11 in number, long, fine, upto $2.5-3.0\times$ as long as the basal diameter of antennal segment III. Antennae 5-segmented, light brown, $0.43-0.44\times$ as long as the body ; segment I and II each with 2 hairs ; flagellum striate over surface, striae appearing as reticulation ; segment III $0.63-0.65\times$ as long as hind tibia, a little thicker than the latter and bearing 22-24 annular secondary rhinaria distributed over entire length ; segment IV with 10-12 and V with 7-8 similar rhinaria ; hairs on the flagellum hardly discernable. Ultimate rostral segment bearing 4 long preapical hairs. Thoracic tergum dark brown. Abdominal dorsum pale except at sclerotic areas around marginal hairs and around spiracles ; hairs on the dorsum of abdomen long, fine, arising from conspicuous bases, up to $3.0-3.5\times$ as long basal diameter of antennal segment III ; 7th and 8th tergite each with 4 long hairs of which spinal ones on 7th and on 8th $4.0\times$ and $5.0\times$ as long as the mentioned diameter, respectively. Siphunculi pore-like, surrounded by wrinkled annular striation. Cauda with 10-11 hairs. Legs yellowish brown ; femora, tibiae and tarsi with spinulose striae, these are denser on tibiae and tarsi ; hairs on tibiae fine, up to $1.5\times$ as long as the width at the middle of tibiae ; first tarsal segments with 3, 3 hairs of which middle one being short, stiff, others fine and at least $2.0\times$ as long as the middle one. Forewings with pterostigma little dusky, anal distinctly bordered brown and thicker than others ; hind wings with both obliques.

Colour : Brown to dark brown in life.

Measurements in mm :

Length	Width	Antenna		
1.6	0.68	0.70		
1.7	0.70	0.72		
		Antennal segment	urs	ht ₂
III	IV	V		
0.32	0.16	0.12	?	0.08
0.33	0.16	0.13	?	0.08

(1, 2 ex unidentified host, Lamahat, West Bengal, 3.v.1970, C.U. colls).

Sexual forms : Not known.

Material examined : 10 apterous and 2 alate viviparous females, from unidentified host plant, Lamahat, Darjeeling district, West Bengal, India, 3.v.1974, coll. S. D. Chakraborti (Holotype and Paratypes, C.U. Colls).

Discussion : The species is distinctive in having 4 hairs on 8th abdominal tergite and variable hairs on prosoma. These insects form small colonies on undersurface of older leaves of host plant at temperate condition and remain covered with waxy section.

Distribution : INDIA : West Bengal.

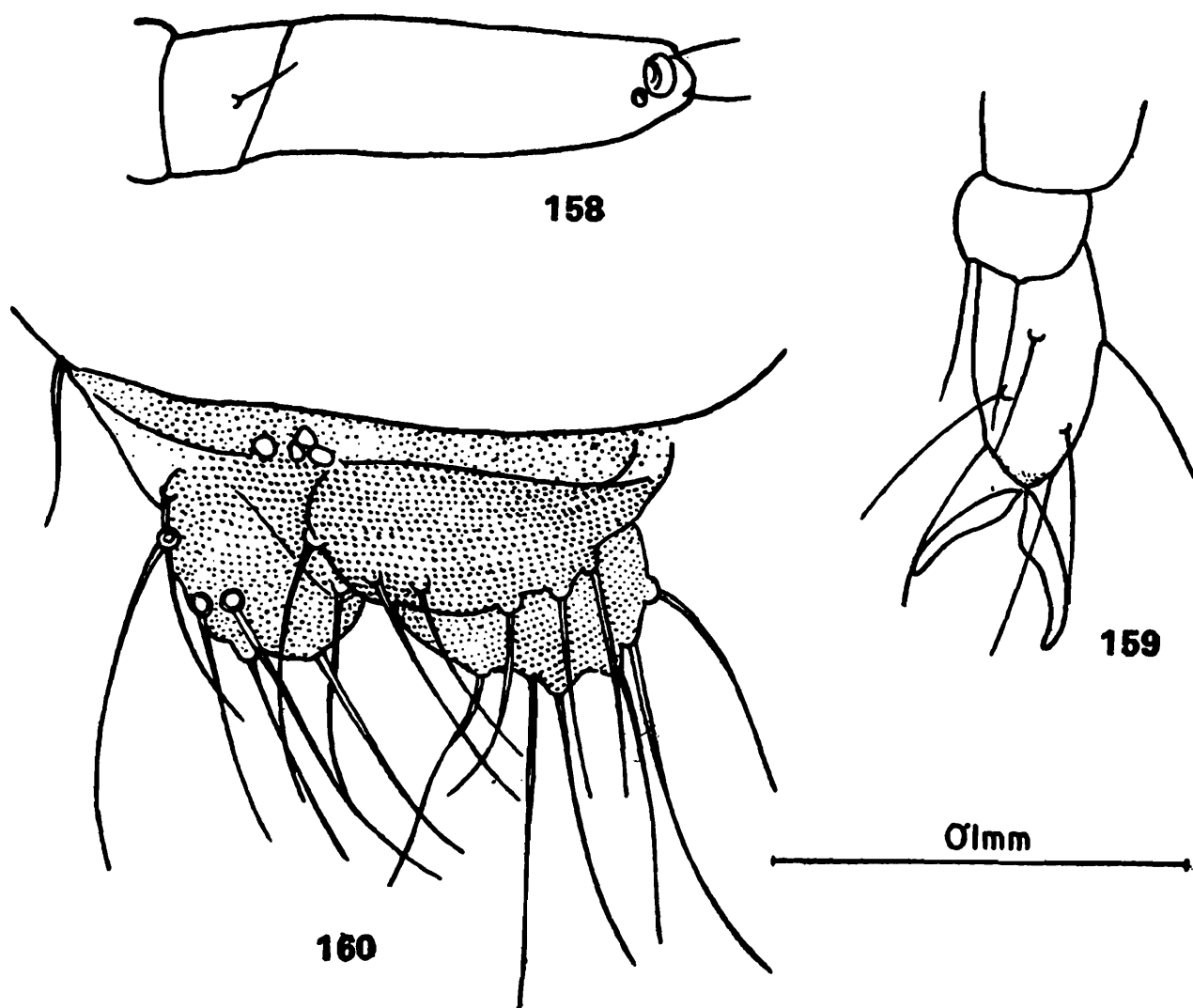
Types : In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India.

19. *Euthoracaphis longisetosa* Ghosh and Raychaudhuri
(Figs. 158-161)

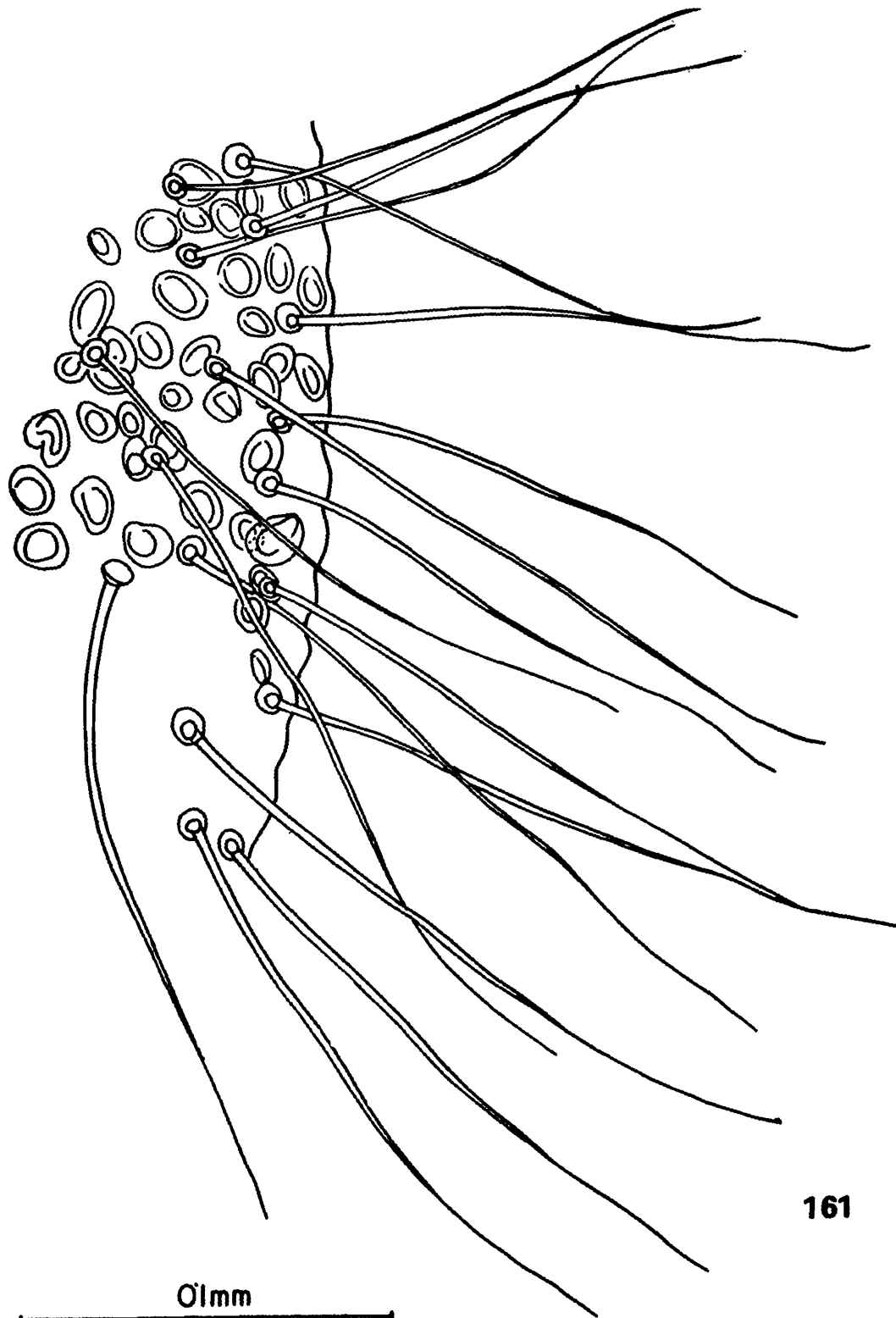
1973. *Euthoracaphis longisetosa* Ghosh, A. K. and Raychaudhuri, D. N., *Kontyu*, 41 (2) : 157.
1976. *Euthoracaphis longisetosa*, Eastop, V. F. and Hille Ris Lambers, D., *Survey of the Worlds Aphids*, 197.

1980. *Euthoracaphis longisetosa*, Raychaudhuri, D. N., Ghosh, M. R., Pal, P. K., Ghosh & A. K. In Aphids of North-East India and Bhutan, 374.

Apterous viviparous female : Body blackish, sclerotic, thickend and bearing numerous fine, long hairs. Antennae 3-segmented ; segment III nearly smooth, $0.70\times$ as long as hind tibia and bearing rhinaria, placed wide apart. Rostrum with segments 4 and 5 distinct, at least $1.3\times$ as long as second segment of hind tarsus. Prosoma in matured adult distinctly divided by sutures into a large median quadrangular and an anterior and two lateral areas, bearing distinct, protuberant semioval pustules ; hairs on prosoma long, fine, numerous on dorsum and marginal area, about as long as the



Euthoracaphis longisetosa A. K. Ghosh & Raychaudhuri. Apterous viviparous female ; 158, antenna ; 159, second segment of hind tarsus ; 160, caudal region.



Apterous viviparous female : 161, part of dorsum showing long hairs.

antenna. Abdominal segments (2-7) fused, defined from prosoma, nearly smooth and bearing a number of fine submedian hairs, up to

0.57-0.86 $\times$ as long as the antenna ; submarginal and posteromesial hairs not discernible ; 8th tergite with 2 long, thick hairs. Siphunculi small pore-like. Cauda constricted at base, distinctly knobbed. Subanal plate bilobed, each lobe with a number (3) of long fine hairs. Legs pale, hairs on tibiae long and fine, those on hind tibiae longer than the width at the middle of tibiae ; tarsi 2-segmented ; claws normal ; first tarsal segment with 3, 3, 3 hairs.

Colour : Not recorded.

Measurements in mm :

	Length	Width	Antenna		
1.	?	?	0.10		
2.	?	?	0.11		
	Antennal segment			urs	ht ₂
	I	II	III		
	0.015	0.015	0.078	0.068	0.046
	0.014	0.015	0.077	0.067	0.044

(1, 2 *Senecio* sp., Rahung, Arunachal Pradesh, 28.xii.1969, C.U. colls).

Other morphs : Not known.

Material examined : 4 apterous viviparous females from *Senecio* sp., Rahung (c 3,200 m), Kameng district, Arunachal Pradesh (=NEFA), 28.xii.1969, coll. H. Banerjee (Holotype and Paratypes : C.U. Colls).

Discussion : The species is close to *E. umbellalariae* (Essig) which infests *Cinnamoum* in Japan and U.S.A., in having long, fine dorsal hairs on prosoma and 2 hairs on 8th abdominal tergite but can be separated by its protuberant pustules, longer dorsal hairs and different host association. These insects infest undersurface of leaves of host plant.

Distribution : INDIA—Arunachal Pradesh.

Types : In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India.

Genus 5. Hemipodaphis David, Narayanan and Rajasingh, 1971

1971. *Hemipodaphis* David, S. K., Narayanan, K., Rajasingh, S. G., *Orient Insects*, 5 : 559 ; Estop, V. F. and Hille Ris Lambers, D, 1976. Survey of the World's Aphids. 213.

Type species : *Hemipodaphis monstrata* David, Narayanan, Rajasingh.

Morphology : Body broad, dorsum covered with hemispherical nodules. Antennae 3-segmented, hardly $0.10\times$ as long as the body ; primary rhinaria ciliated. Eyes of 3 facets. Rostrum hardly reaches hind coxae ; ultimate rostral segment with a pair of accessory hairs ; stylets $3.5\times$ as long as the rostrum. Dorsal hairs long, sparse, thick with acute apices, 3-7 per segments on 1-7th tergites 8th tergite with 1-2 hairs ; spiracles present on 1st-7th abdominal segments, without sclerites. Wax plates circular, pitted, variably present on head, thorax and abdomen ; each plate with 3-6 faces surrounded by a thick rim. Siphunculi absent. Cauda knobbed with 3 long stiff hairs, and with a thick black sheath. Legs short, stout, trochanters fused with femora ; tarsi rudimentary.

Discussion : The genus is monotypic and shows clear affinity with *Thoracaphis* and related genera. Ghosh, A. K. (1981) placed it closest to *Atarsaphis* Takahashi but differing from the later in the fewer number of hairs on 8th tergite, longer marginal hairs and in having 3-segmented antennae, besides completely different host association and pattern of infestation. It is interesting to note that during last more than 10 years this species (*monstrata*) has never been recorded again, inspite of extensive field survey conducted in the Darjeeling region (type-locality).

Biology : Nothing is known about the biology of the single member of the genus except that it forms colonies on leaf bases of an unidentified lily-like plant with bulbous roots during November at temperate condition. Besides adult apterae, third instar nymph and pre-marginal form were also collected which resemble the adults in all essential features except in somewhat smaller size of 3rd instar nymph.

Distribution : INDIA : Darjeeling.

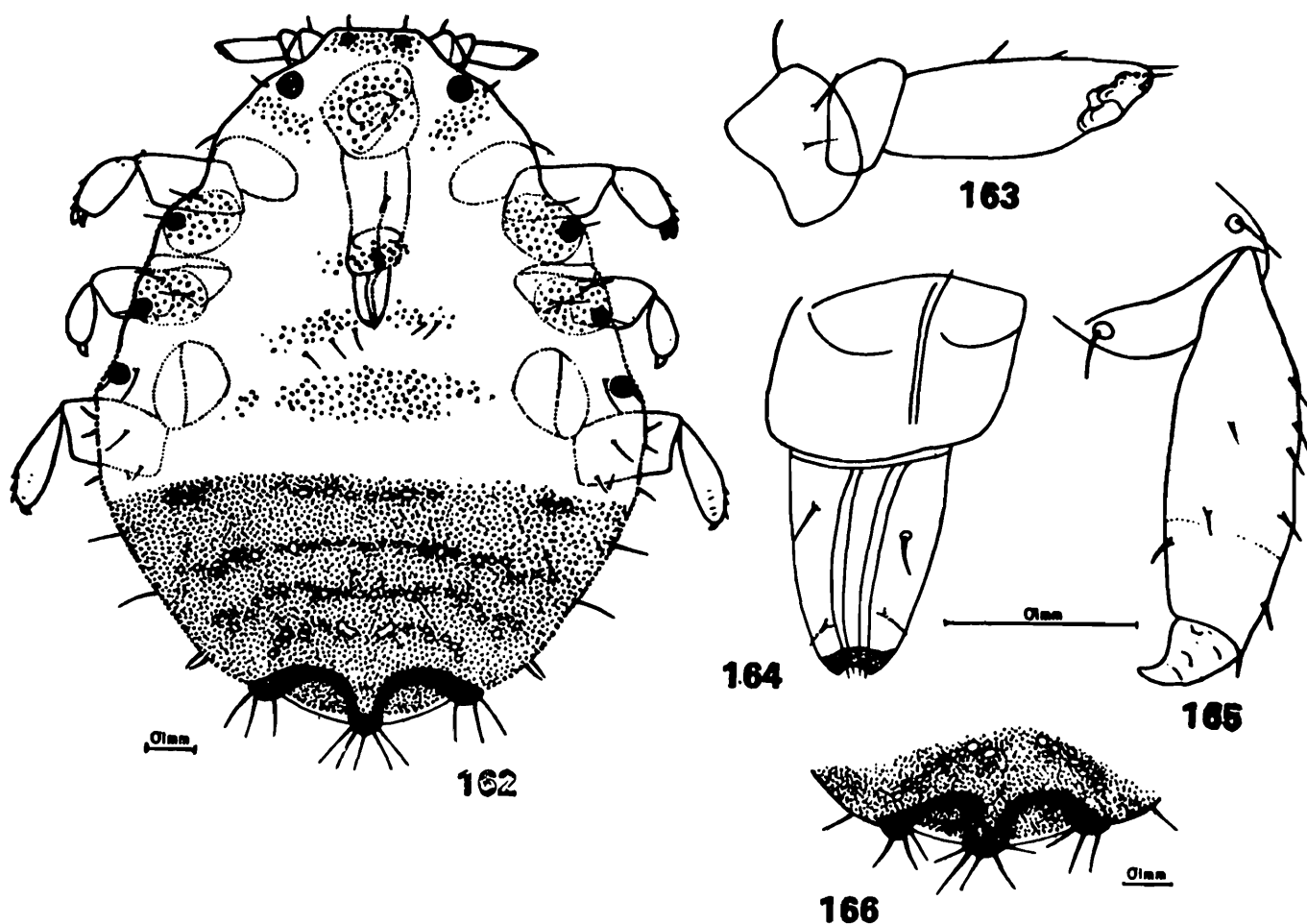
Type-species : *Hemipodaphis monstrata* David, Narayanan and Rajasingh, 1971. Holotype and two paratypes deposited in the collections at Madras Christian College, Madras, India ; one paratype deposited in the National Zoological Collection, Z.S.I., Calcutta ; other (not specified) deposited in the collections of D. Hille Ris Lambers, Bennekom, The Netherlands and Dr. V. F. Eastop, British Museum (Nat. Hist.), London.

**20. *Hemipodaphis monstrata* David, Narayanan and Rajasingh
(Figs. 162-166)**

1971. *Hemipodaphis monstrata* David S. K., Narayanan, K., Rajasingh S. G., *Orient Insects*, 5 (4) : 560
1972. *Hemipodaphis monstrata*, Eastop, V. F. and Hille Ris Lambers, D., *Survey of the World's Aphids*, 213.

Apterous viviparous female : Body broadly oval, 0.96-1.21 mm long, with 0.66-0.80 mm as maximum width. Head with frons convex covered with hemispherical nodules ; dorsal cephalic hairs, a total of five pairs, 0.03-0.04 mm long ; venter of head with two large circular pit-like wax plates, each composed of 4-6 granular cells. Eyes of 3 facets. Antennae 3-segmented, segment I and II with some longitudinal wrinkles ; hairs on antennae sparse, 0.08-0.012 mm long ; segment III with 2 small circular rhinaria near the apex, placed side by side and 4 acute hairs at the apex. Rostrum short, stout, reaching hind coxae ; ultimate rostral segment obtuse bearing a pair of accessory hairs and with stylets very long, nearly $3.0-3.5 \times$ as long as the rostrum. Thoracic tergum covered with nodules except on some spino-pleural patches in pronotum. Abdominal dorsum covered with nodules similar to those on head and thorax, tergites bearing darker in colour, caudad ; intersegmental membrane pale between 1st and 2nd tergites ; four intersegmental membranes lying between 3rd-4th to 6th-7th pleural region bear small circular white areas spino-pleural region ; hairs on dorsum of abdomen sparse, 6-7 on each of 1st-3rd tergites, and 3-4 on each of 4th-6th tergites ; 7th tergite with 2-5 hairs and 8th tergite with a single spinal hair besides a pair, included in the anocaudal structure. Wax plates present on thorax and 1st-5th and abdominal segment in the following order pronotum ; one spinal (0.03 mm diam) and one

lateral (0.04 mm diam), pair ; mesonotum ; one pleural (0.02 mm diam) and one lateral (0.04 mm diam pair ; metanotum ; one pleural (0.03 mm diam) and one lateral (0.04 mm diam) pair ; abdominal segment 1 ; one pleural and one lateral pair ; segment 2-4 ; one lateral pair (0.03-0.05 mm diam) ; segment 8 : one pleural pair (0.05 mm diam). Siphunculi absent. Posterior margin of abdomen, from 7th tergite, covered with a thick, black, w-shaped marginal sheath with a median protuberance appearing like cauda which bears 5 long stiff and thick hairs ; on either side of median caudal structure broad was plates (0.07 mm $\times$ 0.10 mm) appear to fill up the U-shaped like depressions. Subanal plate (0.03 $\times$ 0.05 mm), placed ventrally at the base of cauda small, bearing spinules and 2 long hairs ; subgenital plate (0.08 $\times$ 0.19 mm) rectangular, also bears spinules and 4 hairs ; both subanal plate and subgenital plate form a part of consolidated anocaudal structure. Legs stout, short ; hairs on



Hempodaphis monstrata David, Narayanan & Rajasingh. Apterous viviparous female ; 162, whole body ; 163, antenna ; 164, ultimate rostral segments ; 165, hind tarsus ; 166, caudal region.

legs short, thick, acute arising from large sockets ; trochanters fused with femora, the latter becoming progressively wider from fore to hind legs ; tibiae short, spindle shaped, bearing a row of short, stout hairs ; tarsi not discernible, claws large 0.018-0.030 mm long.

Colour : Not recorded.

Measurements in mm. :

	Length	Width	Antenna
1.	10.3	0.77	0.15
2.	1.21	0.80	0.15

Antennal segments			urs
I	II	III	
0.043	0.031	0.078	0.08
0.043	0.030	0.082	0.09

(1, 2 unidentified plant, Darjeeling, II.xi.1969, SKD colls.).

Alate viviparous female : Not known.

Nymphs : Not available for present study. The following measurements are from David et al. (1971).

Measurements in mm. :

	Length	Width	Antenna			
1.	0.94	0.61	0.132			
2.	0.77	0.49	0.128			

Antennal segments			Hind	Hind	Cauda
I	II	III	foemur	tibia	
0.039	0.027	0.066	0.148	0.14	0.08
0.031	0.023	0.074	0.152	0.14	0.08

(1, Preimaginal nymph ; 2, third instar nymph, from unidentified plant, Darjeeling, 11.xi.1969).

Material examined : Two apterous viviparous females from unidentified host plant, Darjeeling, West Bengal, India, 11.ix.1969,

Coll. S. G. Rajasingh and K. Narayanan (Holotype, S. K. David's collections, Paratype, Z.S.I. Colls.).

Discussion : This species was collected from nearly dried-up outer leaves of an unidentified lily-like host plant with bulbous root. In spite of extensive survey and collections in Darjeeling Hill areas no further collection of this species has been reported so far which is perhaps indicative of its rare occurrence.

Distribution : INDIA : West Bengal.

Types : In the collections of S. Kanakaraj David, 22 Kamaraj Avenue, Madras, India (Holotype and Paratypes) ; D. Hille Ris Lambers, Bennekdim, The Netherlands (Paratype) ; British Museum (Nat. Hist.), London, England (Paratype) ; Zoological Survey of India, Calcutta (Paratype).

Genus 6. *Indonipponaphis* Ghosh and Raychaudhuri 1973

1973. *Indonipponaphis* Ghosh, A. K. and Raychaudhuri, D. N., *Kontyu*, 41 : 156 ; Raychaudhuri, D. N., Ghosh, M. R., Pal, P. K., Ghosh, A. K. 1980. *In*. Aphids of North East India and Bhutan, 376. Type species : *Indonipponaphis tuberculata* Ghosh and Raychaudhuri.

Morphology : Body thick, semioval, pustulate over dorsum. Head, thorax and abdominal segment 1 fused (Prosoma) ; prosoma densely covered with numerous round or oval pustules, conspicuously protuberant on lateral margins ; thick finger-shaped tubercles present on median and submarginal areas of prosoma, besides a prosteromesial pair at the hind end. Antennae 3-segmented, shorter than or nearly equal to the distance between them ; primary rhinaria round, non-ciliated, protuberant, placed wide apart. Eyes of 3 facets. Rostrum with segments 4 and 5 distinct, ultimate rostral segment $1.4-1.5\times$ as long as second segment of hind tarsus. Abdominal segments 2-7 fused, with indistinct papillae and paired tubercles on median and submarginal areas of 2nd and 3rd tergites ; 4th to 7th tergites with thick, blunt and submarginal setae ; posteromesial setae on 7th tergite absent but a pair of small tubercles present near the hind end ; 8th tergite with 4 setae. Siphunculi poriform. Cauda semioval, constricted at base. Sub-anal plate bilobed. Legs pale, tarsi two-segmented ; first tarsal segments with

3, 3, 2 hairs ; second tarsal segments with a pair of dorso-apical hairs, expanded at apices.

Alate and other morphs not known.

Discussion : The genus was described with a single species *tuberculata* by Ghosh, A. K. and Raychaudhuri (1973); subsequently Sorin (1979) described a second species *fulvicola* from *Quercus acuta* in Japan but both the species remain to be known only from apterae. The possession of distinct finger-line tubercles separates this genus from *Nipponaphis* and other related genera.

Biology : *I. tuberculata* forms moderate colonies on the stem of *Quercus*, species of which acts as a host of many related species of Hormaphidinae. However, *Q. dealbata* is known to have only a second species, *Thoracaphis* sp., in North East India. The period of infestation is reported to be in March-April. *I. fulvicola* infest branch of *Quercus acuta*. No other details about biology is available.

Distribution : INDIA (Meghalaya).

Type species : *Indonipponaphis tuberculata* A. K. Ghosh & Raychaudhuri, 1973. In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta.

21. *Indonipponaphis tuberculata* Ghosh & Raychaudhuri (Fig. 167)

- 1973. *Indonipponaphis tuberculata* Ghosh, A. K. and Raychaudhuri, D. N., *Kontyu*, 41 (2) : 158.
- 1976. *Indonipponaphis tuberculata*, Eastop, V. F. and Hille Ris Lambers, D., *Survey of the World's Aphids*, 227.
- 1980. *Indonipponaphis tuberculata*, Raychaudhuri, D. N., Ghosh, M. R., Pal P. K., Ghosh, A. K. *In Aphids of North East India and Bhutan*, 377.

Apterous viviparous female : Body pale brown 1.9—2.1 mm long with 1.3—1.4 mm as maximum width. Antennae 3-segmented, 0.16—0.17 × as long as the body, segment I and II enlarged, segment III with two rhinaria, placed wide apart. Eyes of 3 facets. Rostrum reaches at least forecoxae ; segment 4 and 5 distinct, about 1.4 × as

long as second segment of hind tarsus and bears 4 preapical hairs. Prosoma covered with numerous round to oval pustules which appear distinctly protuberant in marginal area ; four pairs of distinct finger-shaped dorsal tubercles present along median area of prosoma besides 5 submarginal pairs and a posteromesial pair; hairs on the dorsum stiff and blunt, hardly exceeding basal diameter of antennal segment III in length. Abdominal segments (2-7) fused, distinctly defined from prosoma, bearing a few indistinct papillae and paired tubercles on submedian and submarginal areas of 2nd and 3rd tergites ; 4th-7th tergites, each with a pair of submarginal hair ; 7th tergite with a pair of tubercles at the hind end ; 8th tergite with 4 hairs, blunt at apices. Siphunculi small, pore-like. Cauda semioval, much broader than long, with 8-9 long hairs. Anal plate bilobed. Legs, pale ; hairs on tibiae of variable lengths with acute apices ; tarsi 2-segmented ; first tarsal segments with 3, 3, 2 hairs, dorso-apical pair of hairs on 2nd segment, expanded at apices.

Measurements in mm :

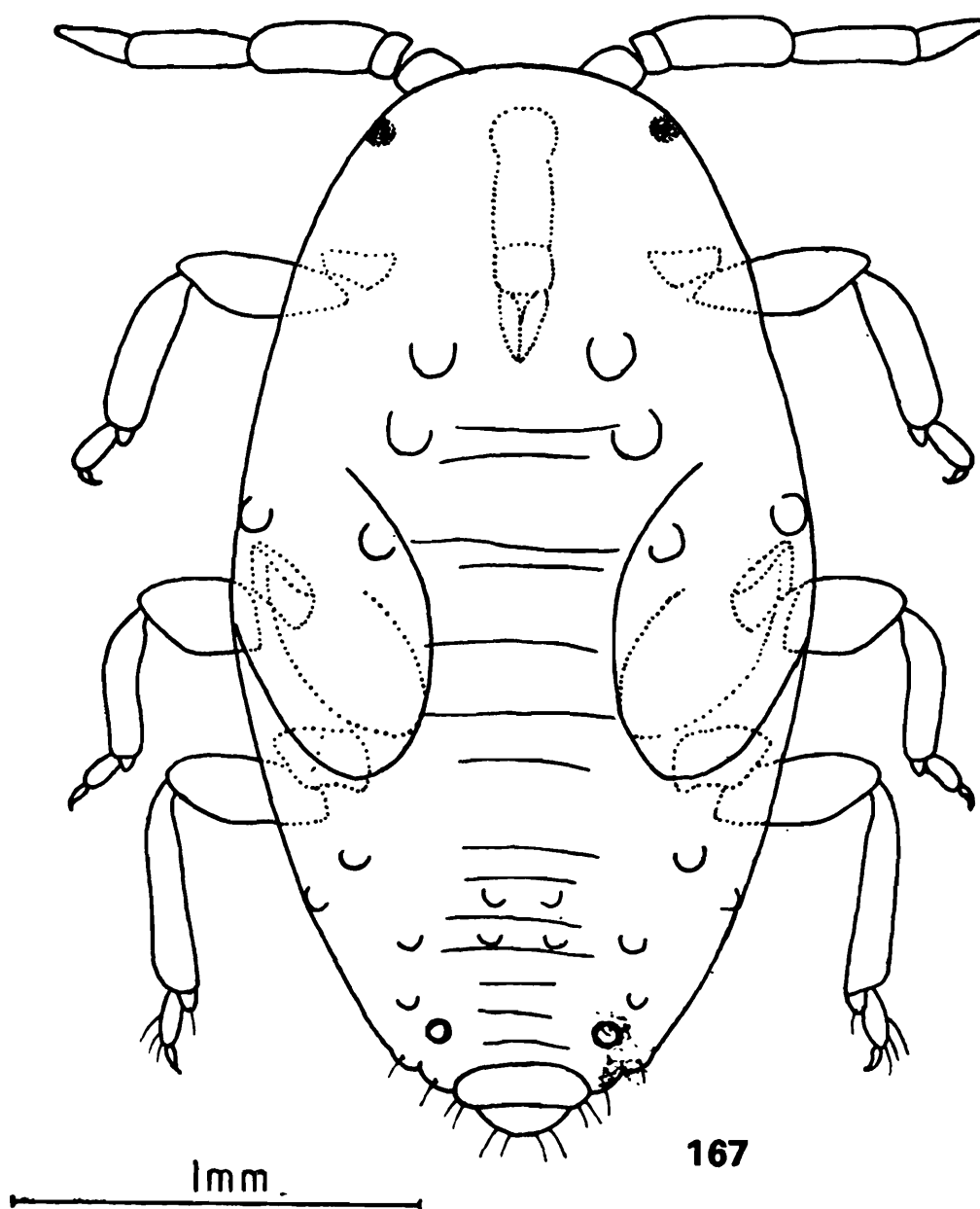
	Length	Width	Antenna	
1.	1.9	1.3	0.30	
2.	2.1	1.8	0.35	
	Antennal segments		urs	hts.
I	II	III		
0.04	0.05	0.021	0.10	0.07
0.04	0.05	0.026	0.11	0.08

(1, 2, ex. *Quercus dealbata*, Shillong, Meghalaya, 3.iv. 1970, C. U. Coll).

Other morphs : Not known.

Material examined : 5 apterous viviparous females from *Quercus dealbata*, Shillong, Meghalaya, India, 13.iv.1970. Coll. H. Banerjee, (C. U. Colls. : Holotype and Paratypes).

Discussion : The species makes small colony on the stem of the host plant. No biological information is otherwise available.



Indonipponaphis tuberculata A. K. Ghosh & Raychaudhuri. Alate nymph
167, whole body.

Distribution : INDIA : Meghalaya.

Types : In the collection of Entomology Laboratory, Department of Zoology, University of Calcutta, India.

Genus 7. *Metanipponaphis* Takahashi, 1959

1959. *Metanipponaphis* Takahashi, R., *Bull. Univ. Osaka, Pref. (B)*. 9 : 5 ;
Ghosh, A. K. and Raychaudhuri, D. N., 1973, *Kontyu*, 41 (2) : 159 ;

Raychaudhuri, D. N., Ghosh, M. R., Pal, P. K., Ghosh, A. K., 1980,
In Aphids of North East India and Bhutan, 379.

Type species : *Metanipponaphis rotunda* Takahashi.

Morphology : Body in apterae sclerotised, semicircular. Prosoma indistinctly separable from anterior fused part. Dorsum with numerous scattered pustules, appearing double rimmed, when cleared ; pustules on prosoma may become spiny, horn-like on pleural region. Antennae 3-segmented in apterae, 5-segmented in alatae ; primary rhinaria small, rounded, ciliated in apterae, in alatae not differentiated ; secondary rhinaria in alatae, subannular, present in all flagellar segments. Eyes of 3 facets in apterae, normal in alatae. Rostrum with 4 and 5 segments distinct and ultimate rostral segment nearly equal to much longer ($\times 1.8$) than the second segment of hind tarsus, usually without accessory hairs. Abdominal segments 2-7 fused, variably corrugated or with scattered pustules and bear 6 pairs of submarginal hairs ; posteromesial hairs on 7th tergite absent ; 8th tergite with 2 hairs. Siphunculi small, pore-like, cauda dark, sclerotic, constricted at base, bearing a few fine hairs. Subanal plate bilobed with 4-6 hairs on each lobe. Spiracles distinct, surrounded by small pustules. Legs short, first tarsal segments with 3, 3, 2 hairs ; dorsoapical hairs on second tarsal segments expanded at apices. Forewings with media once branched ; cubitus and anal clouded along border and nearly fused at base ; hind wings with both obliques.

Discussion : Takahashi (1959) described the genus and included two new species, *rotunda* and *shiicola* and also suggested the inclusion of *Thoracaphis lithocarpicola* Takahashi, under it ; the genus is considered as closest to *Lithoaphis* differing in flattened prosoma bearing numerous circular or subcircular dorsal pustules. Subsequently, Takahashi (1962) transferred *Nipponaphis cuspidatae* Essig & Kuwana to the genus and Ghosh, A. K. and Raychaudhuri (1973) while dealing with *Nipponaphis* and related genera, added one more species, *assamensis* from Northeast India. Later, Ghosh, A. K. (1974) added a second species *echinata* from the same region. Tao (1966), while revising the Chinese Hormaphidinae, suggested inclusion of three other species, of which only *T. silvestrii* Takahashi 1935, is now included under this genus. As such, a total of seven species are known from the World under *Metanipponaphis*, all of

them being confined to East and South East Asiatic countries. The relationship of *Metanipponaphis* appears to be close to *Schizoneuaphis* on one side and *Thoracaphis* on the other, in the nature of tarsus, siphunculi, prosoma, posteromesial setae, and cauda while it shows affinity with *Lithoaphis* in minute and sparse marginal hairs and first tarsal chaetotaxy. Three species including two endemic are known from Indian region.

Biology : The members of the genus largely infest plants of Hamamelidae specially, *Distylium*, *Castanopsis*, *Lithocarpus*, of which only *Distylium* is known to act as primary host of *cuspidatae* on which it forms galls and as such, it may be presumed that the group has evolved through heteroecious life cycle alternating between Hamamelidiaceae and Fagaceae, but has now become mostly anholocyclic on Fagaceae ; at least one species, *Matanipponaphis silvestrii* (Tak.) is also known from *Lindera* of Lauraceae under Mangolidae in India.

All the three species from the Indian region, known only from North East India, appear to be monoecious anholocyclic in nature.

Distribution : INDIA : FORMOSA ; JAPAN.

Type species : *Metanipponaphis rotunda* Takahashi, 1959 ; deposited in the collection of Entomological Institute, Hokkaido University, Sapporo, Japan.

Key to species of *Metanipponaphis*

Apterous viviparous female :

1. Prosoma with numerous round to irregular pustules, these becoming distinctly spiny and hook-like on marginal area. Dorsal hairs on prosoma, short and inconspicuous.....*M. echinata* A. K. Ghosh
- Prosoma with round, oval, polygonal pustules but these never appear spiny, hook, like on marginal region.....2

2. Body large, 1.7-1.8 mm. long. Prosoma densely covered with pustules, rounded or polygonal, Dorsal hairs long and fine, upto $2.4-2.6 \times$ as long as the basal diameter of antennal segment III.....*M. assamensis* A. K. Ghosh & Raychaudhuri

Body small, upto 1.0 mm. long. Prosoma with groups of pustules on mid-dorsal region, often appearing as radiating out from a center ; lateral perpendicular area with polygonal pustules. Dorsal hairs fine, upto $1.2-2.0 \times$ as long as the basal diameter of antennal segment III.....*M. silvestrii* (Takahashi)

22. *Metanipponaphis assamensis* Ghosh & Raychaudhuri (Figs. 168-172)

1973. *Metanipponaphis assamensis* Ghosh, A. K., and Raychaudhuri, D. N., *Kontyu*, 41 (2) : 160.
1976. *Metanipponaphis assamensis*, Eastop, V.F. and Hille Ris Lambers, D. Survey of the World's Aphids, 277.
1980. *Metanopponaphis assamensis*, Raychaudhuri, D. N., Ghosh, M. R., Pal, P. K., Ghosh, A. K. In Aphids of North East India and Bhutan, 379.

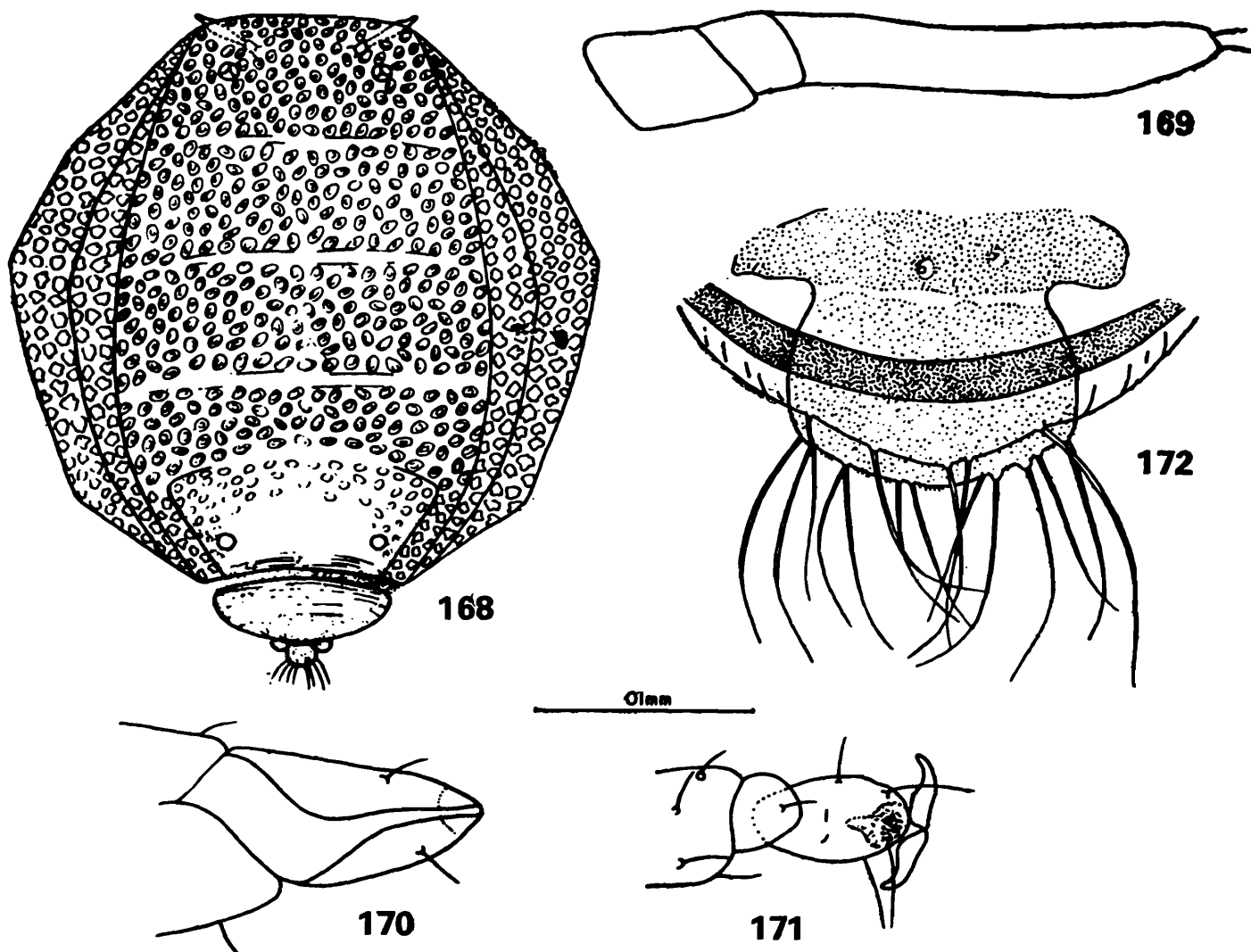
Apterous viviparous female : Body semioval, light brown to yellow, 1.7—1.8 mm long. Antennae 3-segmented, $0.11-0.12 \times$ as long as the body, distance between antennae nearly as long as the antennae ; segment III more than twice as long as I and II taken together, with rhinaria placed wide apart. Rostrum with segment 4 and 5 distinct, together $1.5 \times$ as long as second segment of hind tarsus. Prosoma with numerous polygonal to irregular shaped pustules on lateral perpendicular area, sometime extending upto sub-marginal area, pustules on the rest of the dorsum mostly appear double-rimmed ; hairs on the dorsum of prosoma long and fine, usually $2.4-2.6 \times$ as long as the basal diameter of antennal segment III ; mid-dorsal hairs often triplicated. Abdominal segments (2-7) fused, separated from prosoma only along lateral margins but even then incompletely, along median line with some indistinct polygonal sculptures or corrugations and with 6 pairs of submarginal hairs ; 8th abdominal tergite dark sclerotic, corrugated, with a pair of hairs. Siphunculi small, pore-like. Cauda dark, sclerotic, with 9-10 hairs. Subanal plate bilobed, dusky, each lobe bearing 6 long hairs. Legs pale except apices of tibiae and whole of tarsi which are dusky, tarsi two-segmented ; claws normal ; first tarsal segments with 3, 3, 2 hairs.

Colour : Brown to dark brown in life.

Measurements in mm :

	Length	Width	Antenna	
1.	1.70	1.4	0.20	
2.	1.68	1.4	0.20	
Antennal segments			urs	ht ₂
I	II	III		
0.03	0.03	0.14	0.075	0.050
0.02	0.03	0.15	0.073	0.052

(1, 2 ex. *Castanopsis tribuloides*, Shillong, Meghalaya, 12.iii.1969, C. U. Colls.).



Metanipponaphis assamensis A. K. Ghosh & Raychaudhuri. Apterous viviparous female : 168, whole body ; 169, antenna ; 170, ultimate rostral segment ; 171, hind tarsus ; 172, caudal region.

Material examined : 4 apterous viviparous females from *Castanopsis tribuloides*, Shillong, Meghalaya, India, 12.iii.1969, Colls. S. Biswas (Holotype and Paratypes : C. U. Colls.).

Discussion : This species appears close to *M. cuspidatae* (Essig & Kuwana) but is separable from the latter by much longer and more numerous dorsal hairs on prosoma besides in the arrangement of the hairs. No biological information is available for this species.

Distribution : INDIA : Meghalaya.

Types : In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India.

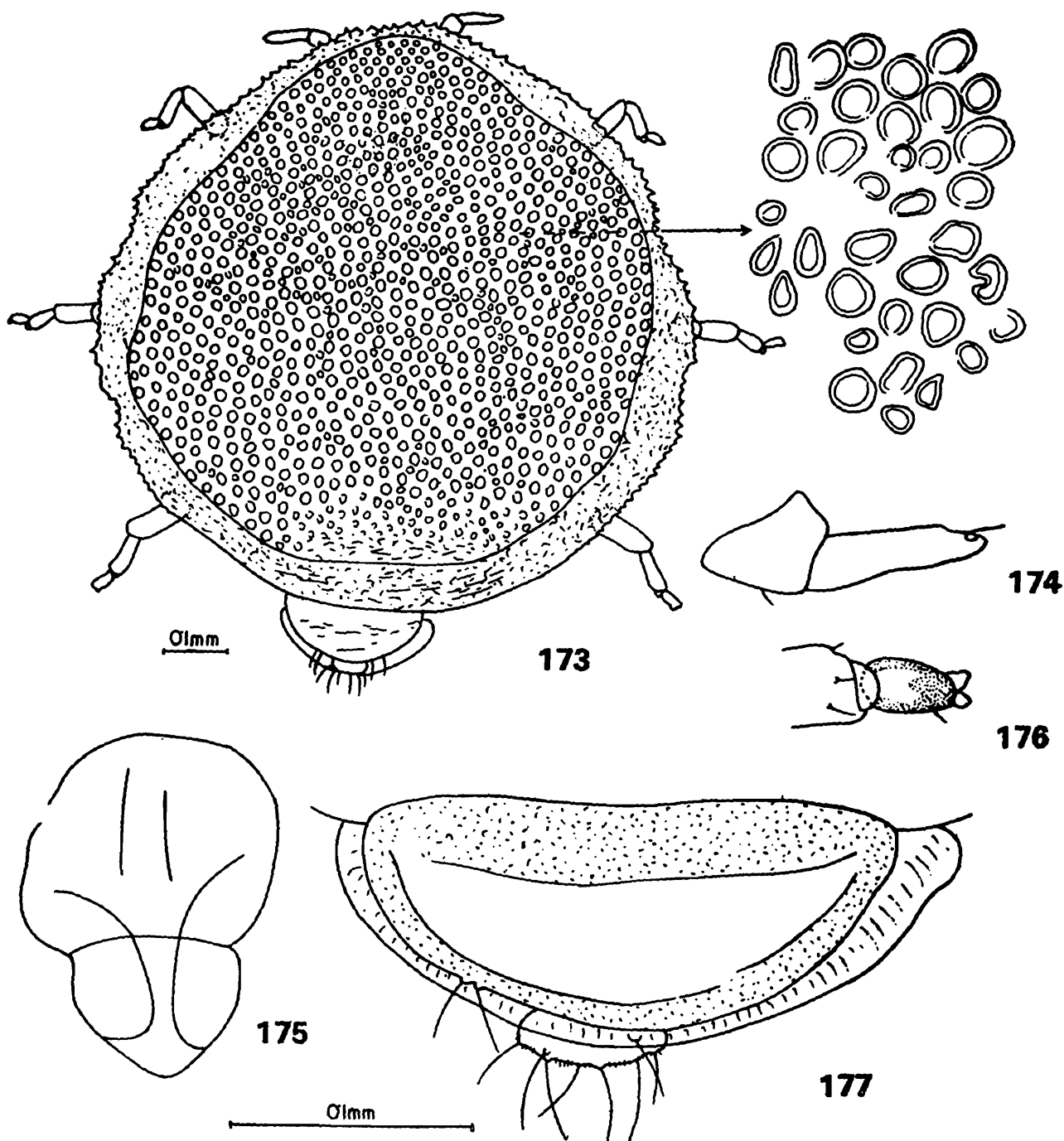
23. *Metanipponaphis echinata* Ghosh (Figs. 173-177)

1974. *Metanipponaphis echinata* Ghosh, A. K., *Orient. Insects*, 8 : 429.
1976. *Metanipponaphis echinata*, Eastop. V. F. and Hille Ris Lambers, D., *Survey of the World's Aphids*, 277.
1980. *Metanipponaphis echinata*, Raychaudhuri, D. N., Ghosh, M. R., Pal, P. K., Ghosh, A. K. *In Aphids of North East India and Bhutan*, 380.

Apterous viviparous female : Body semioval, light to darkbrown, 0.75—0.90 mm long with 0.58—0.62 mm as maximum width. Antennae 3-segmented, 0.13-0.14× as long as the body, distance between antennae nearly 1.4× as long as the antenna ; segment III with rhinaria placed little apart. Rostrum with segments 4 and 5 distinct 4+5 about 1.5—1.7× as long as second segment of hind tarsus. Prosoma with numerous irregular pustules on lateral perpendicular areas, these pustules becoming spiny and prolonged hook-like structures on marginal areas ; punctules on the dorsum of prosoma mostly appear double-rimmed ; hairs on prosoma short, inconspicuous. Abdominal segments (2-7) fused, separated from prosoma only along lateral margin ; dorsum of abdomen with semioval to irregular pustules, which become irregular, corrugated sculptures, cauded ; submarginal hairs hardly discernible ; 8th tergite dark, sclerotic, corrugated, with a pair of hairs. Siphunculi small, pore-like. Cauda dark, sclerotic bearing 11-12 long, fine hairs. Anal

plate biolobed, each lobe bearing at least 6 hairs. Legs yellowish brown ; tarsi two-segmented, claws normal ; first tarsal segments with 3, 3, 2 hairs.

Colour : Brownish in life.



Metanipponaphis echinata A. K. Ghosh. Apterous viviparous female : 173, whole body ; 174, antenna ; 175, ultimate rostral segment ; 176, hind tarsus, 177, caudal region.

Measurements in mm :

	Length	Width	Antenna		
1.	0.82	0.61	0.10		
2.	0.88	0.65	0.10		
	Antennal segments			urs	ht ₂)
I	II	III			
0.03	0.02	0.05	0.55		0.035
0.03	0.02	0.05	0.53		0.030

(1, 2 or ex *Castanopsis histrix*, Old Barapani, Meghalaya, 7.vii.1973, Z.S.I.).

Other morphs : Not known.

Material examined : 6 apterous viviparous females from *Castanopsis histrix*, old Barapani, Meghalaya, India, 7.vii.1973, Coll. A. K. Ghosh, (Types ; Z.S.I. Colls.).

Discussion : The presence of very prolonged and hooked marginal pustules, helps to separate out the present species from other species of the genus. This species forms small colonies on leaves of *Castanopsis histrix* and appears to be restricted in distribution.

Distribution : India : Meghalaya.

Types : In the National Zoological collections, Zoological Survey of India, Calcutta, India.

24. *Metanipponaphis* ? *silvestrii* (Takahashi)
(Figs. 178-182)

1935. *Thoracaphis silvestril* Takahashi, R. *Lingnan J. Sci.*, **14** : 137.
1966. *Metanipponaphis silvestril*, Tao, C.C.C., *Quart J. Taiwan Mus.*, **19** : 176
1973. *Metanipponaphis silvestrii*, Ghosh, A. K. and Raychaudhuri, D. N. *Kontyu*, **41** (2), 161.

1976. *Metanipponaphis ? silvestrii*, Eastop, V.F. and Hille Ris Lambers, D., Survey of the World's Aphids, 277.
 1980. *Metanipponaphis silvestrii*, Raychaudhuri, D.N., Ghosh, M.R., Pal, P. K., Ghosh, A. K. In Aphids of North East India and Bhutan, 380.

Apterous viviparous female : Body subcircular, 1.04—1.08 mm long. Head fused with thorax. Antennae 3-segmented, distance between antennae, $1.3 \times$ as long as the antennae ; segment III with a small circular rhinarium near the middle, the other one being not clearly discernible. Rostrum short ; ultimate rostral segment 0.66 mm long, about $1.9 \times$ as long as second segment of hind tarsus with 6 fine hairs on the frons, 0.033—0.040 mm long, besides 4 hairs between the eyes, which may be upto 0.033 mm long. Prosoma covered with numerous polygonal to irregular pustules on lateral areas besides at least groups of pustules arranged in four pairs along mid dorsum, dorsal hairs on prosoma, straight, rather thick, 0.014—0.016 mm long, at most equal to the basal diameter of antennal segment III. Abdominal segment 2-7 fused, with traces of segmentation, separated from prosoma only along lateral margin and incompletely on dorsum, bearing 6 (?) pairs of submarginal hairs ; 8th tergite sclerotic bearing 2 hairs. Siphunculi minute. Cauda dark, sclerotic bearing at least 4 stiff hairs, 0.06-0.07 mm long. Anal plate dark-bilobed. Legs pale ; hairs on legs sparse, stiff and acute ; apices of hind tibiae with 3 such setae on each side arising from tuberculate bases, hardly 0.01 mm long ; tarsi 2-segmented ; first tarsal segments with 3, 3, 2 hairs ; second tarsal segments (on hind legs) with 4 fine hairs, upto 0.026 mm long.

Colour : Dark brown in life.

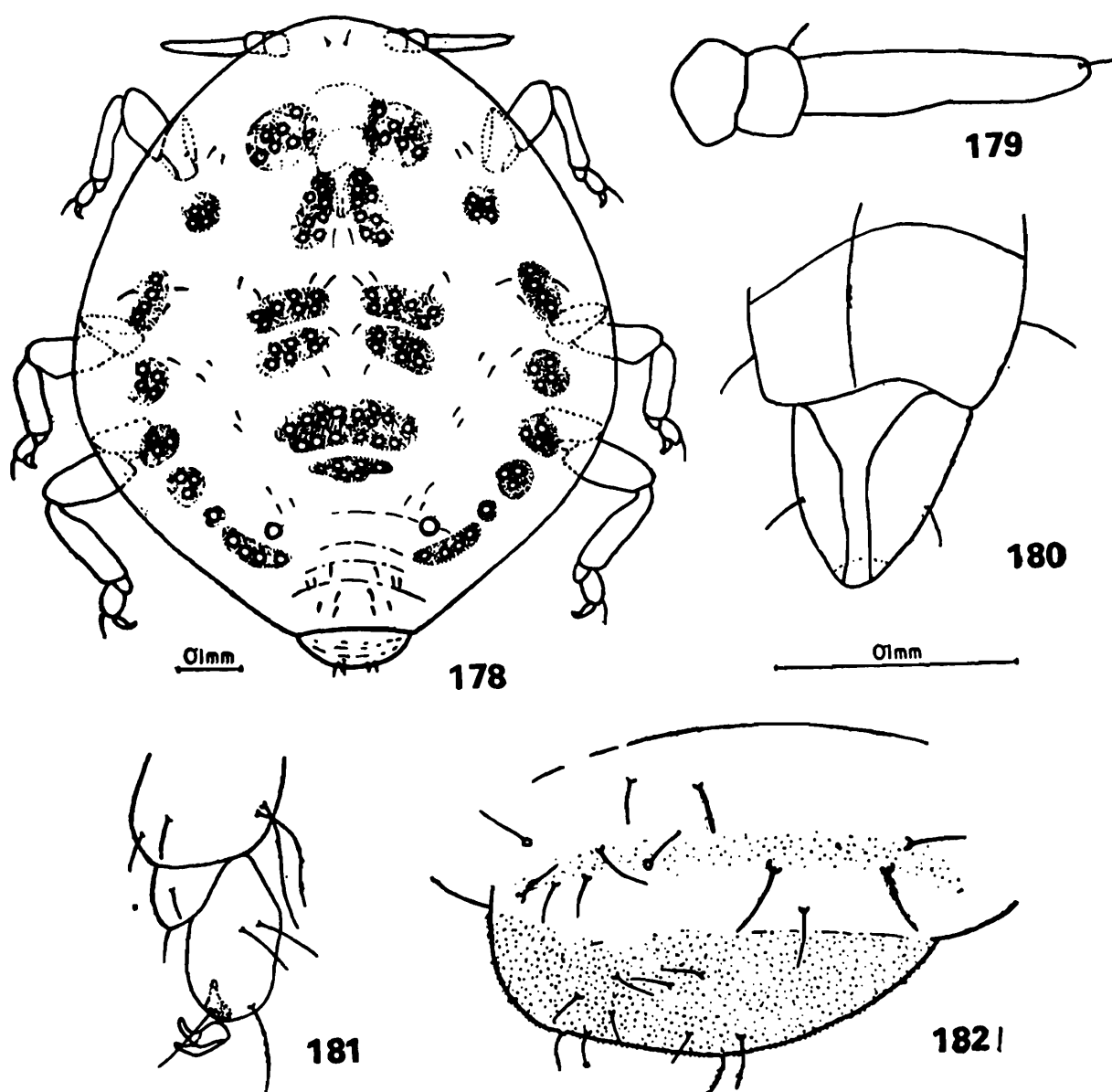
Measurements in mm :

	Length	Width	Antenna	
1.	1.04	0.82	0.113	
2.	1.08	0.82	0.114	
Antennal segments			urs	ht ₂)
I	II	III		
0.021	0.026	0.076	0.060	0.033
0.02	0.027	0.075	0.060	0.034

(1, 2 ex. *Lindera* sp., Kaziranga, Assam, 19.xii. 1972, ZSI Colls.).

Material examined : 10 apterous viviparous females from *Lindera* sp., Kaziranga, Assam, India, 19.ii.1972, Coll. A. K. Ghosh (ZSI Colls.).

Discussion : Takahashi (1935), while describing the species, has given a detailed description of the species from unknown host in



Metanipponaphis silvestrii (Takahashi). Apterous viviparous female ; 178, whole body ; 179, antenna ; 180, ultimate rostral segment ; 181, hind tarsus ; 182, caudal region.

China. He also mentioned about 4 groups of papillae on mid-dorsal areas of prosoma as shown in the figure provided by Tao (1966).

Ghosh and Raychaudhuri (1973) and Hille Ris Lambers (in litt.) mentioned that the present material is not congeneric with the type of *Metanipponaphis* ; it can be provisionally identified as *silvestrii*, following Tao (op. cit). The species forms small colonies on the leaves of host-plant.

Distribution : INDIA : Assam ; CHINA.

Types : In the collections of Agricultural Research Institute, Taipei, Taiwan.

Genus 8. *Neothoracaphis* Takahashi, 1958

1958. *Neothoracaphis* Takahashi, R. *Bull. Univ. Osaka Pref.* (B), 8 : 1 ; Ghosh, A. K. and Raychaudhuri, D. N., 1973, *Kontyu*, 41 (2) : 164 ; Eastop, V.F. and Hille Ris Lambers, D., 1976, Survey of the World's Aphids, 317 ; Raychaudhuri, D. N., Ghosh, M.R., Pal, P. K., Ghosh, A. K., 1980, *In* Aphids of North East India and Bhutan. Type species : *Nipponaphis yanonis* Matsumura.
1958. *Microthoracaphis* Takahashi, R. *Bull. Univ. Osaka Pref.* (B), 8 : 4 ; Ghosh, A. K. and Raychaudhuri, D. N., 1973, *Kontyu*, 41 (2) : 162 ; Eastop, V. F. and Hille Ris Lambers, D., 1976, Survey of the World's Aphids, 317. Type species : *Microthoracaphis elongata* Takahashi.

Morphology : Body depressed, oval, sclerotised in apterae, normal in alatae. Prosoma separated from fused abdominal segments (2-7) which appear much reduced ; dorsum of prosoma without wax pore, may be with mosaic-like pattern, or corrugated. Antennae unsegmented and ventral in apterae, 5-segmented in alatae, primary rhinaris hardly discernible ; secondary rhinaria in alate subannular. Eyes of 2-3 facets in apterae and normal in alatae. Rostrum short, two-segmented in apterae, normal in alatae ; ultimate rostral segment longer than wide, without any accessory hairs. Abdominal segments 2-7 completely fused, without sub-marginal hairs, sometimes with minute circular markings ; mid-dorsal hairs absent ; 8th tergite with 4 hairs. Siphunculi absent in apterae, pore, like in alatae. Cauda broader than long, usually constricted at base. Subanal plate indented. Legs in apterae concealed under body, fore-and mid-legs very short, without tarsi, hind, legs longer and

exposed, with rudimentary tarsi bearing short, thick spine, like hairs and a pair of dorso-apical hairs with expanded apices ; claws minute or absent ; alatae with tibiae distinctly imbricated and bearing stiff hairs ; dorso-apical hairs on second tarsal segments expanded at apices and longer than claws ; first tarsal segments with 3, 3, 2 hairs. Forewings broad, pterostigma short, media once branched ; hind wings with both obliques.

Larvae show distinct wax pores. Oviparae and males apterous, with rostrum (Takahashi, 1920).

Discussion : The genus was described by Takahashi (1958) with two species, *Nipponaphis vanonis* Matsumura and *Thoracaphis tarokoensis* (Takahashi). Ghosh, A. K. and Raychaudhuri (1973) considered the genus as composed of 3 species, including *Astegopteryx quercicola* (Takahashi). Takahashi (1958) described another genus *Microthoracaphis* with *M. elongata* Takahashi, as its type-species and included four other species viz. *M. glaucae* Takahashi, *M. querciphaga* Takahashi, *Thoracaphis saramaoensis* (Takahashi) and *Thoracaphis sutepensis* (Takahashi). Tao (1966) described another genus *Microunguis*, related to *Neothoracaphis* Takahashi and *M. crothoracaphis* Takahashi, with *Thoraacaphis depressus* Takahashi as its type. Ghosh, A. K. and Raychaudhuri (1973) considered all these genera as valid but Eastop and Hille Ris Lambers (1976) treated *Microthoracaphis* and *Microunguis* as complete synonyms of *Neothoracaphis*. A reappraisal of three genera indicates very close affinities in morphological characters of alienolae viz. unsegmented antennae, dorsal corrugation or reticulation and absence of papillae, absence of dorsal and submarginal hairs, number of hairs on 8th tergite etc., but while in members of *Neothoracaphis* and *Microthoracaphis*, tarsi are rudimentary and may be without any claws and siphunculi are absent in apterae, the type species of *Microunguis* i.e. *depressus* possesses distinct tarsi and claws and small but distinct siphunculi. As such, *Microunguis* can still be regarded as a distinct genus.

A total of nine species are now recognised ; three species *N. distyfoliae* Takahashi, *N. distylifoliae* Takahashi, *N. distylii* Pergande *sensu* Easig and Kuwana, all described from *Distylium*, are now considered as synonyms of the type species *vanonis* Mat-

sumura. The genus with its peculiar assemblage of characters, appears to be more primitive amongst the Nipponaphidine genera and close to *Quernaphis* Takahashi, and *Atarsaphis* Takahashi (Ghosh, A. K., 1981).

Biology : Eight out of nine species of *Neothoracaphis* lead anholocyclic life cycle on plants of Fagaceae, largely on *Quercus* spp., which obviously represent the original secondary host ; only the type species, *yanonis* (Matsumura) is still known to retain a heteroecious holocycle, forming galls on *Distylium racemosum* and migrating to *Quercus dentata* and *Q. serrata* in Japan ; in this species, which is very common in Honshu and Kyushu in Japan (Takahashi 1962), alate fundatrigeniae emerge from small galls on the foliage in late May and June and migrate to the leaf of deciduous *Quercus* spp. and alate sexuparae from *Quercus* return to *Distylium* in autumn completing the cycle. The leaf galls usually start to form in April and attain full growth by end of May. Sorin (1966) has given details of morphogenesis and histology of galls produced by *yanonis* on *Distylium*. Most of the species on *Quercus* are known by apterous aliencolae. The Indian specimens appear closest to *sutepensis* (Takahashi) and have been collected during September-February on *Quercus*.

Distribution : India ; Thailand ; Formosa ; Japan.

Type species : *Nipponaphis yanonis* Matsumura, 1917 ; location of types not known.

Key to the species of *Neothoracaphis*

Apterous viviparous females :

Body small 0.69—0.69 mm long, slightly indented in the margin. Fore-and-mid legs concealed under the body without any apparent tarsi. Abdomen distinctly defined from prosoma.....*N. sutepensis* (Takahashi)

Body 0.73—0.78 mm long, distinctly indented in the margin. Fore-and-mid legs with atrophied tarsi. Abdomen not clearly defined from prosoma on all sides.....*N. garhwalensis*
Chakrabarti and Raha

Table VI. Morphological characters in Apterae aliencolae

Apterae : Characters	Genus Microthoracaphis	Genus Neothoracaphis	Genus Microunguis
Antenna	Unsegmented	Unsegmented	Unsegmented
Prosoma	Corrugated/nonreticulated	mosaic-like/corrugated	corrugated/reticulated
Hairs on middorsum	absent	absent	absent
Abd. seg.	fused	fused	fused
Submarginal hairs	absent/with pores	absent	absent
8th tergite	4 hairs + 2 pairs of circular marking	4 hairs	4 hairs
Tarsi	rudimentary	absent or rudimentary	normal without claws
Siphunculi	absent	absent	present
Host-Plant	Quercus	Quercus, Distylium	Quercus

25. *Neothoracaphis garhwalensis* Chakrabarti and Raha
(Figs. 183-187)

1985. *Neothoracaphis garhwalensis* Chakrabarti, S. and Raha, S., *Ann. Zool.*,

Apterous viviparous female Body oval, sclerotised, 0.75-0.78 mm long with 0.56-0.63 mm as maximum width, indented at frontal and lateral margins. Antennae very small, unsegmented, 1.1-1.3× as long as wide, rounded at tip and placed ventrally. Eyes of 2 facets. Prosoma with distinct polygonal mosaic sculptures on dorsum, except along longitudinal area of mid-dorsum. A pair of minute hairs present between the eyes. Rostrum two segmented ; second segment without any secondary hairs. Abdominal segments (2-7) fused, distinctly separated from prosoma only along lateral margin, besides a pale transverse area, with distinct polygonal reticulations but without any submarginal hairs or circular markings ; 8th tergite with transverse striations on posterior portion and bears small hairs. Siphunculi absent. Cauda broader than long, constricted basally. Anal plate bilobed with 5-6 hairs on each lobe. Fore and middle legs short, concealed under the body, femora longer than tibiae, tarsi atrophied, unsegmented, with some minute conical processii ; hind legs exposed, femora distinctly stouter but almost equal to tibiae, tarsi with a few conical processii and a pair of hairs (0.013) which appear little capitate at apices.

Colour : Dark brown in life.

Measurements in mm :

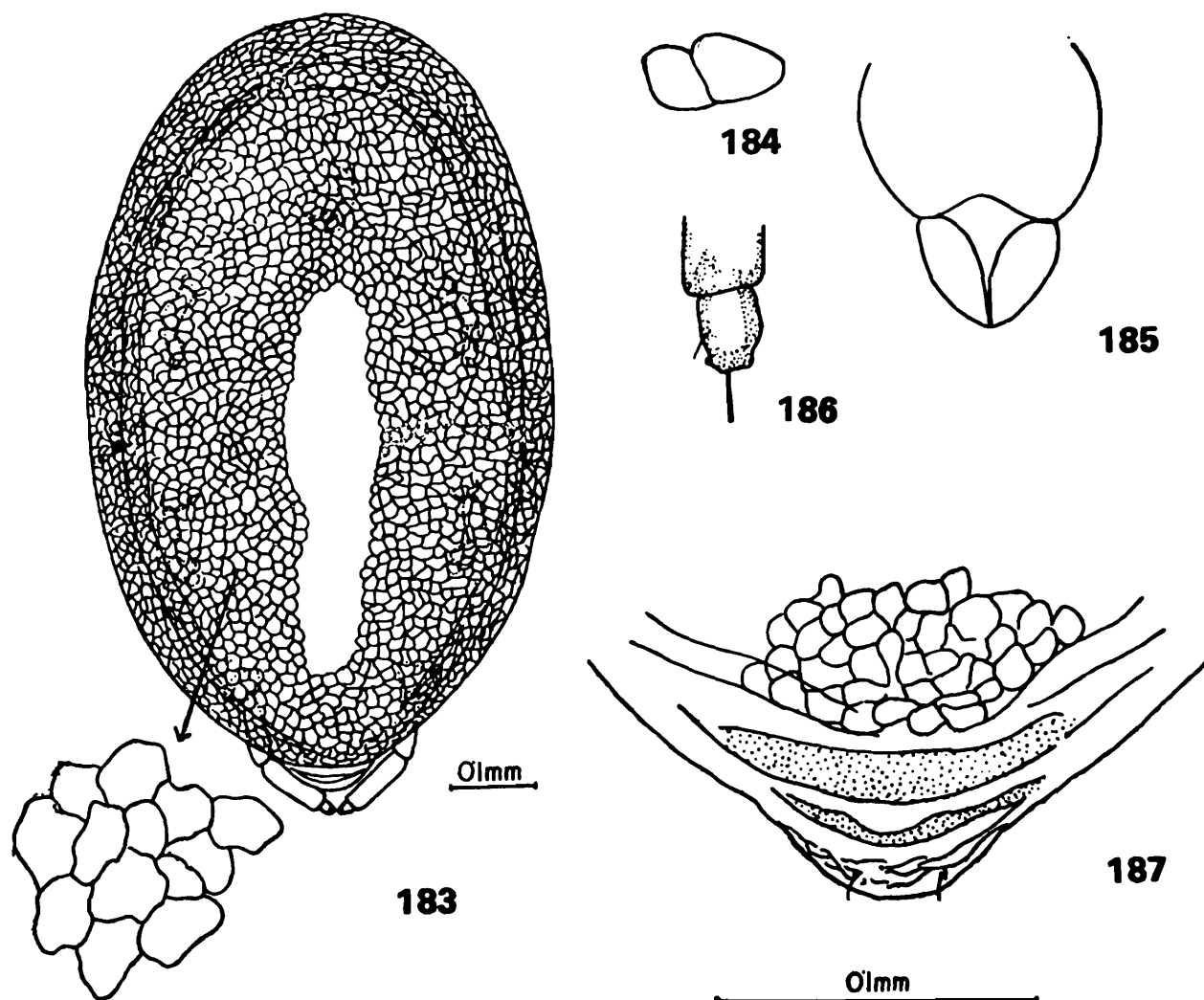
	Length	Width	Antenna	hind tibia	hind tarsus
1.	0.75	0.56	0.03	0.076	0.023
2.	0.78	0.61	0.03	0.077	0.023
3.	0.73	0.52	0.03	0.073	0.023

(1, 2, 3 ex. *Quercus incana*, Janakichatti, Uttar Pradesh, 18. × .81, K. U. Coll.).

Other morphs : Not known.

Material examined : Six apterous aliencolae from *Quercus incana*, Janakichatti (c. 2200 mm) Uttar Pradesh, India, 18.×.1981, Coll. S. Raha (Paratypes ; K. U. Colls.).

Discussion : This recently described species closely resembles the type species of the genus, *Neothoracaphis yanonis* (Matsumura) which is known to alternate between *Quercus* spp., and *Distylium racemosum* in Japan, but differs from the former in having indented margin of body, in the atrophied tarsi in fore-and-mid legs and the abdomen (2—7) not being distinctly defined all along the



Neothoracaphis garhwalensis Chakrabarti & Raha. Apterous viviparous female :
183, whole body ; 184, antenna ; 185 ultimate rostral segment ; 186, tarsus ;
187, caudal region.

margin from prosoma, besides in somewhat longer size of the body. This species forms colonies on leaves of the host plants and is often attended by ants.

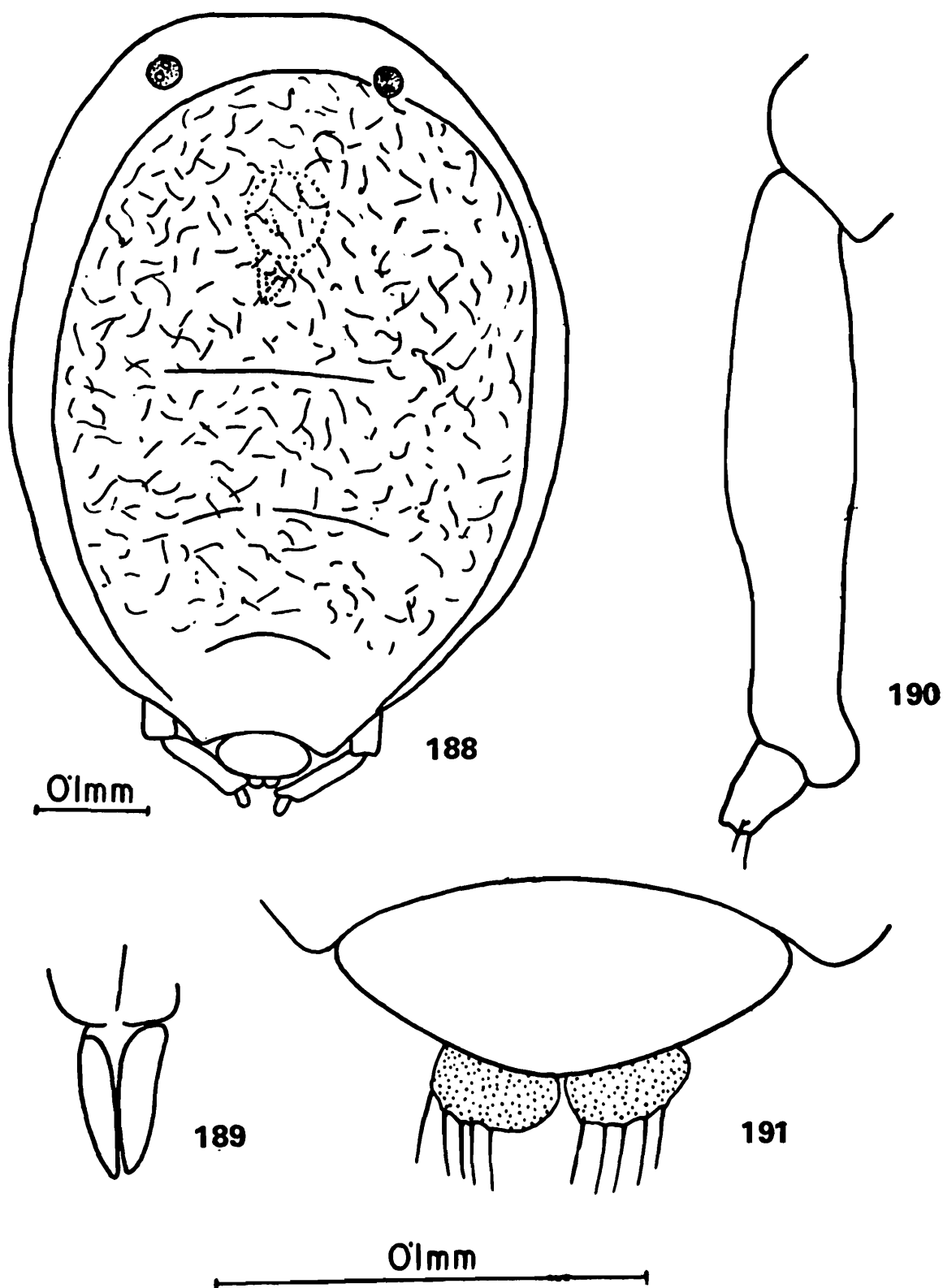
Distribution : India : Uttar Pradesh.

Types : In the Biosystematic Research Unit, Department of Zoology, University of Kalyani, Kalyani, India.

26. *Neothoracaphis sutepensis* (Takahashi) (Figs. 188-191)

- 1941. *Thoracaphis sutepensis* Takahashi, R., *Rept. Taiwan Govt. Agric. Res. Inst.*, 78 : 22.
- 1969. *Microthoracaphis sutepensis*, Tao, C.C.C., *Sc. Yb. Taiwan Mus.*, 12 : 96
- 1974. *Neothoracaphis* sp., Ghosh, A. K., *Orient. Insects*, 8 : 171.
- 1976. *Neothoracaphis sutepensis*, Eastop, V.F., Hille Ris Lambers, D., *Survey of the World's Aphids*.
- 1980. *Neothoracaphis* sp., Raychaudhuri, D. N., Ghosh, M. R., Pal, P. K., Ghosh, A. K. *In Aphids of North East India and Bhutan*, 383.

Apterous viviparous female : Body 0.49-0.69 mm long (0.46-0.58 mm) with 0.35-0.48 mm as maximum width, blackish brown, strongly sclerotised and subcircular in appearance. Antennae unsegmented, very small rounded at apex. Eyes of 2-3 facets. Rostrum short, 2-segmented ; ultimate rostral segment 0.03 mm long, and without secondary hair. Prosoma large, sclerotic, dark brown but paler in the median area, lacking hairs and with 3 transverse furrows in the median region ; dorsum with many, irregular shallow corrugations, which sometimes form a pattern specially along pleural area ; ventrally, marginal area distinct. Abdominal segments (2-7) fused, distinctly defined from prosoma. Submarginal hairs absent ; 8th tergite small, distinct, rounded at the hind end and bears 4 hairs. Siphunculi absent. Cauda distinctly knobbed bearing 5-6 hairs with acute apices. Anal plate bilobed, concealed under the body, each lobe with at least 4-5 hairs. Legs short ; fore and mid legs concealed under the body and without any distinct tarsi ; hind legs with tibiae as long as coxae and femora taken together, about $1.0\times$ as long as wide ; hind tarsi $1.1\times$ as long as wide, unsegmented, without claws and bears a few small (0.01 mm) stiff hairs.



Neothoracaphis sutepensis (Takahashi). Apterous viviparous female : 188, whole body ; 189, ultimate rostral segment ; 190, leg ; 191, caudal region.

Colour : Dark in life with whitish work on mid dorsal area.

Measurements in mm :

	Length	Width	urs.	hind tibia	hind tarsus
1.	0.69	0.48	0.030	0.083	0.020
2.	0.62	0.49	0.030	0.083	0.020
3.	0.49	0.35	0.026	0.073	0.016

(1, 2 ex *Quercus* sp., Sedimpukhri Rd., Manipur, 16. i. 1976 ; 3, ex *Quercus* sp., Mawphlong, Meghalaya, 4. xi. 1972 ; Z.S.I. Colls.).

Other morphs : Not known.

Material examined : 10 apterous allienolae from *Quercus* sp. Sedimpukhri Rd., Manipur, India, 16. i. 1976, Coll. A. K. Ghosh ; 9 apterous aliencolae from *Quercus* sp., Mawphlang, Khashi Hill, Meghalaya, India, 4. xi. 1972, Coll. A. K. Ghosh ; 26 apterous aliencolae from *Quercus* sp., Mawphlang, Khashi Hills, Meghalaya, India, India, 21. ix. 1973, Coll. A. K. Ghosh. (Z.S.I. Colls.).

Discussion : The species was first described by Takahashi (1941) under *Thoracaphis* from a tree of Fagaceae collected on Mt. Sutep near Chiangmai in Thailand during the month of April. Tao (1969) redescribed the species from Taiwan under *Microthoracaphis* which is now considered as a complete synonym of *Neothoracaphis*. Ghosh, A. K. (1974) recorded the species as *Neothoracaphis* sp., from India and re-examination of the specimens from Manipur and Meghalaya region, revealed that Indian specimens agree fairly well with description and figures provided by Takahashi, (1941) and Tao (1969). These small bodied dark coloured insects form small colonies on underside of leaves of *Quercus* at temperate climatic condition.

Distribution : India : Meghalaya, Manipur ; China ; Thailand.

Types : Takahashi (1941) mentioned that types are preserved in his own collections ; may now be located in Taiwan Agricultural Research Institute, Taipei, Taiwan.

Genus 9. *Nipponaphis* Pergande, 1906

1906. *Nipponaphis* Pergande, T., *Ent. News.*, 17 : 205 ; Matsumura, S., 1917, Coll. Essays Nawa, Gifu, 39 ; Ghosh, A. K., and Raychaudhuri D. N., 1973, *Kontyu*, 41 (4): 477 ; Raychaudhuri, D. N., Ghosh, M. R., Pal, P. K., Ghosh, A. K., 1980, *In* Aphids of North East India and Bhutan, 384 ; Type species : *Nipponaphis distychii* Pergande.
1920. *Astegopteryx* (*nec* Karsch, partim), Baker, A.C., *Bull U.S. Dept. Agric.*, 826 : 84 ; Takahashi, R., 1931, *Rep. Dep. Agric. Govt. Res. Inst. Formosa*, 53-85.

Morphology : Body oval, semioval or subcircular in apterae ; alatae normal. Cephalothorax and abdominal segment 1 fused, dorsum pustulated, Antennae short, 3-4-segmented in apterae, 5-segmented in alatae ; primary rhinaria closely placed ; secondary rhinaria subannular, numerous, present on all flagellar segments in alatae. Eyes in apterae of 3 facets. Rostrum short, ultimate rostral segment may be much shorter than second segment of hind tarsus or more than twice as long as the same, usually without any accessory hairs. Abdominal segments 2-7 fused, variably separated from prosoma, with variable pustules and corrugations ; 8th tergite free ; abdominal dorsum with 6 pair of submarginal hairs on 2nd-7th, besides a pair of posteromesial hairs on 7th ; 8th tergite with 4-8 hairs ; dorsal hairs short or long, usually fine. Siphunculi pore-like. Alatae with 4 pairs of abdominal spiracles. Cauda broader than long with a basal constriction and with many hairs. Subanal plate bilobed. Legs normal ; tibial hairs in alate over $1.5\times$ as long as the middle diameter of tibia ; tarsi normal, 2-segmented ; first tarsal segments with 3,3,2 hairs ; second segment of tarsi with a pair of dorsoapical hairs which are always longer than claws and the blunt or expanded apices. Wings infuscated ; forewings with pterostigma truncated, media once branched, anal thick and close to cubitus, at base ; hind wings with both obliques.

Takahashi (1962) mentioned that alate sexupara (of *N. distyliicola* Monzen on *Quercus*) differs from gallicolous fundatrigenia in setal distribution, number of secondary rhinaria, marginal sclerites on abdomen, number of hairs on 8th tergite.

Discussion : The genus *Nipponaphis* Pergande, 1906 is considered as the oldest name available in the tribe Nipponaphidini.

The genus has often been confused with *Astegopteryx* and *Thoracaphis* (Baker, 1920 ; Takahashi, 1931). Ghosh, A.K. and Raychaudhuri (1973) have provided a detailed account of the members of this genus and described four new species, (in addition to 9 species known so far under this genus) and also transferred two more species *T. siamensis* Takahashi and *T. machillii* Takahashi to *Nipponaphis*. Ghosh, A. K. and Raychaudhuri (op. cit) also proposed a new subgenus *Pseudonipponaphis* with *N. machiliphaga* Takahashi as type and included *siamensis* (Takahashi) and two of the four new species, viz., *querciphaga* and *himalayensis* in this subgenus. Eastop and Hille Ris Lambers (1976) added *Anoecia karatanei* Sasaki 1936 to *Nipponaphis* and transferred *N. monzeni* to *Sinonipponaphis* Tao 1966. *Nipponaphis holboelliae* A. K. Ghosh and Raychaudhuri is now treated under *Sinonipponaphis* Tao. As such 14 species are now considered under *Nipponaphis* including 4 species under subgenus *Pseudonipponaphis*.

The species of *Nipponaphis* are restricted to China, India, Thailand and Japan. Within the tribe Nipponaphidini, the genus is considered at the advanced stage of evolutionary scale with normal body, papillated tergum, 3-4-segmented antennae, consolidated prosoma, presence of posteromesial setae, 4 setae on 8th tergite, knobbed cuada, presence of siphunculi and normal tarsus (Ghosh, A. K., 1981).

Biology : The members of this genus are believed to have originated through a heteroecious life cycle, alternating between Hamamelidaceae (*Distylium*) where they produce galls and plants of Lauraceae (*Litsaea*, *Machilus*) or Moraceae (*Ficus*) and Fagaceae (*Castanopsis*, *Quercus*) ; the present day host association also remain restricted to Magoniidae (Lauraceae) and Hamamelidae (Hamamelidaceae, Moraceae, Fagaceae) but only two species are now known to produce galls on *Distylium*, viz., *distychii* Pergande and *distyliicola* Monzen, of which only *distyliicola* represents a complete holocycle ; all other species are known from what one tends to believe to be secondary hosts and represent paracycles in their biology. Sorin (1958) has described the life-cycle of *Nipponaphis distyliicola* (= *gigantea* Takahashi) in Japan, where the sexuparae produce males and females on *Distylium racemosum* ; on mating, females lay eggs, which on hatching pass

through the stages of fundatrix, fundatrigenia and migrants and move to *Quercus glauca* and produce virginogenia and sexupara ; alternatively the virginogenia can lead a anholocyclic viviparous cycle through apterae on *Quercus*.

Takahashi (1962) redescribed the alate sexuparae and apterous alienecola of *distyliicola* in Japan.

Most of the species, who are represented by viviparae, have been collected from October—April on secondary hosts, in the entire area of their present day distribution.

Distribution : India ; China ; Thailand ; Japan.

Type species : *Nipponaphis distychii* Pergande, 1906 ; deposited in U.S. National Museum, Washington, D. C., U.S.A.

Key to the species of *Nipponaphis* S. 1.

Apterous viviparous female :

1. Dorsal hairs fine, of variable lengths, arising from normal basis ; prosoma with postero-mesial hairs.....(*Nipponaphis* S. S.)

Dorsal pustules, round, oval but never thick and spiny. Prosoma defined from fused part of abdomen. 8th tergite with 4 hairs. Ultimate rostral segment $1.6-1.7\times$ as long as second segment of hind tarsus.....*N. (N) manoji* A. K. Ghosh & Rachaudhuri

Dorsal hairs long and thick, arising from somewhat tuberculate basis ; prosoma without postero-mesial hairs at hind end... ..(*Pseudonipponaphis*)

2. Dorsal hairs at most half as long as antennae ; ($0.33-0.50\times$). Submarginal hairs on fused abdominal segments (2-7) almost of similar lengths and hardly exceeding $0.33\times$ the length of antennae.....*N. (P) querciphaga* A. K. Ghosh & Raychaudhuri.

Dorsal hairs very long, at least equal to or longer than antennae.....3

3. Prosoma completely separated from fused abdominal segments (2-7) ; only 4th and 5th pair of submarginal hairs much shorter than others. All dorsal hairs thick, except the ones on lateral perpendicular areas.....*N. (P) machiliphaga*
Takahashi

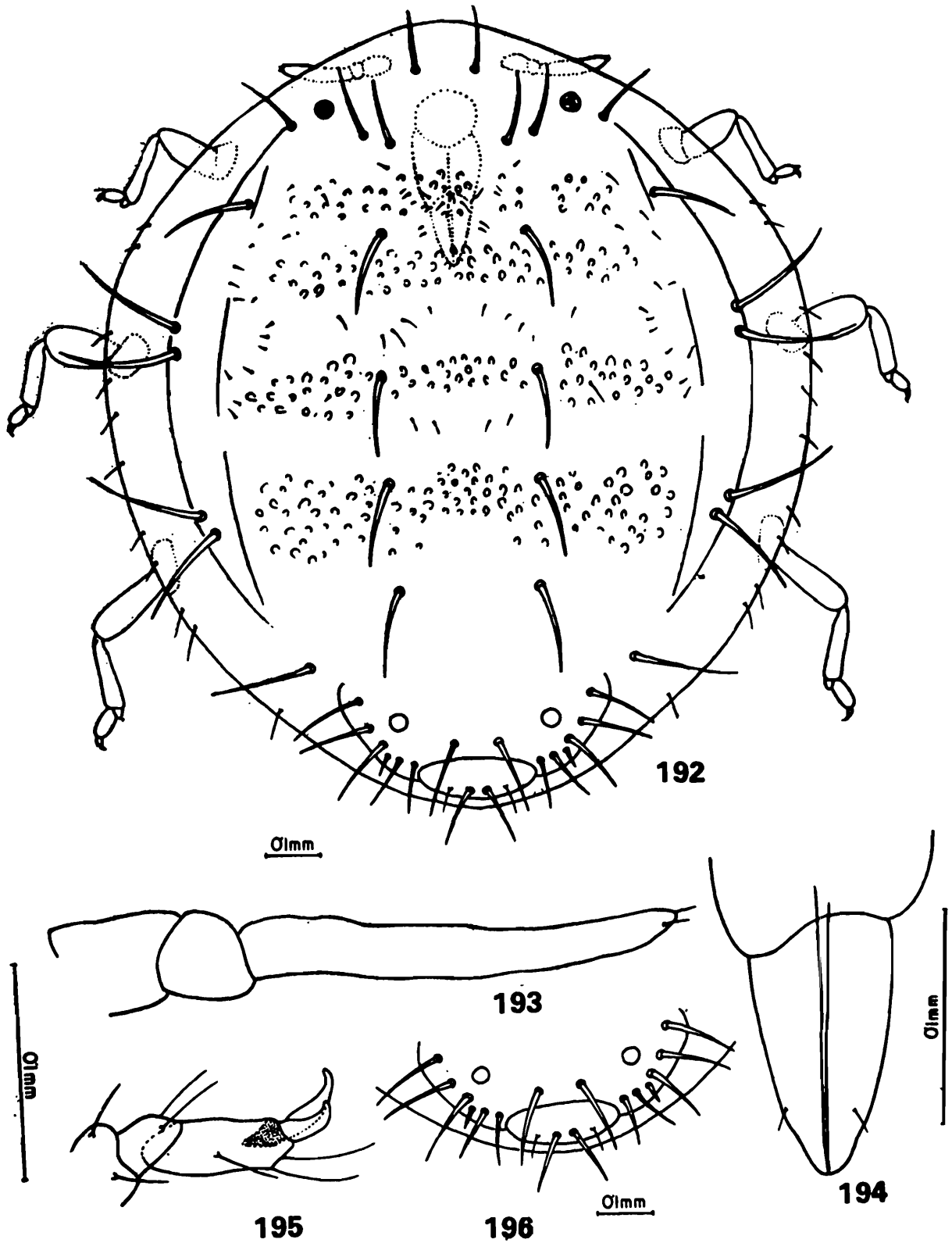
Prosoma incompletely separated from fused abdominal segments (2-7). Dorsal hairs upto $1.25\times$ as long as antennae. Submarginal hairs of variable lengths, first three pairs equal to and last three pairs $0.60\times$, as long as the antennae. Short fine hairs mixed with thick hairs occur on dorsum of prosoma.....*N. (P) himalayensis*
A. K. Ghosh & Raychaudhuri

27. *Nipponaphis* (*Pseudonipponaphis*) *himalayensis* Ghosh and Raychaudhuri

(Figs. 192-196)

1973. *Nipponaphis* (*Pseudonipponaphis*) *himalayensis* Ghosh, A. K., Raychaudhuri, D. N., *Kontyu*, 41 (4) : 483.
1976. *Nipponaphis* (*Pseudonipponaphis*) *himalayensis*, Eastop, V. F. and Hille Ris Lambers, D., *Survey of the Worlds Aphids*, 322.
1980. *Nipponaphis* (*Pseudonipponaphis*) *himalayensis*, Raychaudhuri, D. N., Ghosh, M. R., Pal, P. K., Ghosh, A. K., *In Aphids of North East India and Bhutan*, 387.

Apterous viviparous female : Body dark brown, thickend, 0.90-1.10 mm long with 0.69-0.82 mm as maximum width. Antennae 3-segmented, hardly $0.18\times$ as long as the body ; rhinaria on segment III placed wide apart. Ultimate rostral segment $1.60-1.75\times$ as long as second segment of hind tarsus. Prosoma yellowish brown, indistinctly pappilate over dorsum and submarginal areas ; lateral perpendicular areas nearly smooth ; hairs on dorsum of prosoma of two types, viz., thick hairs, 0.10-0.14 mm long, $1.0-1.2\times$ as long as the antenna, arising from prominent tuberculate bases, distributed over middorsal and submarginal areas and shorter, finer hairs mostly over lateral perpendicular areas, few on dorsum, these being $0.35-0.37\times$ as long as the antenna ; posteromesial hairs on prosoma absent. Abdominal segments



Nipponaphis (P.) himalayensis A. K. Ghosh & Raychaudhuri. Apterous viviparous female : 192, whole body ; 193, antenna ; 194, ultimate rostral segment ; 195, hind tarsus ; 196, caudal region.

(2-7) fused, separated from prosoma around lateral margin and by an incomplete transverse furrow and bearing 6 pairs of sub-marginal hairs, arising from tuberculate bases, of which first 3 pairs are 0.10-0.12 mm long, stout and thick as those on prosoma and subequal to the length of antenna and the last 3 pairs are shorter, thinner, 0.06 mm long, and $0.60\times$ as long as the antenna ; 7th tergite with a pair of thick posteromesial hairs, 0.11-0.12 mm long and nearly as long as the antenna ; 8th tergite with 4 hairs, 2 of which are thicker, 0.90-0.10 mm long and other 2 are thinner and half as long as the thicker hairs. Siphunculi small, pore like. Cauda much broader than long with 8-10 hairs. Anal plate bilobed, each lobe with 5-6 hairs. Legs pale, tibial hairs sparse, fine, hardly as long as the width at the middle of tibia ; tarsi of 2 segments with normal claws ; first segments with 3, 3, 2 hairs.

Colour : Dark brown to black in life.

Measurements in mm :

	Length	Width	Antenna
1.	1.0	0.69	0.14
2.	0.96	0.79	0.15
3.	1.03	0.79	0.16
4.	1.04	0.82	0.15

Antennal segments			urs	ht ₂
I	II	III		
0.02	0.03	0.09	0.07	0.04
0.014	0.026	0.11	0.07	0.04
0.02	0.03	0.11	0.07	0.04
0.024	0.03	0.11	0.08	0.05

(1, ex *Litsaea polyantha*, Kalimpong, West Bengal, 29. x. 1970, C. U. Colls.) 2, ex *Litsaea polyontha*, Kalimpong, West Bengal, 23.iii.1971, C. U. Colls ; 3, ex *Litsaea polyontha*, Kalimpong, West Bengal, 23.iii.1971, C.U. Colls. ; 4 ex *Lindera* sp., Nongthukang, Manipur, 16.iii.1974, Z.S.I. Colls.).

Alate viviparous female : Body 1.9-2.2 mm long with 0.85-0.90 mm as maximum width. Head and thorax dark, sclerotic, abdomen pale ; dorsal cephalic hairs long, fine, nearly $2.0\times$ as long as the basal diameter of antennal segment III. Antennae dark, 5-segmented, $0.42\times$ as long as the body ; antennal segment III with 25-28, IV with 17-18, V with 10-12 annular secondary rhinaria distributed over their entire lengths. Ultimate rostral segment only slightly longer than or equal to the length of second segment of hind tarsus. Abdominal dorsum bearing sclerotic areas around submarginal hairs on posterior tergites and also around spiracles and siphunculi ; submarginal hairs long thick, $3.5-4.0\times$ as long as the basal diameter of antennal segment III ; 7th and 8th tergite sclerotic ; 8th tergite with 4 hairs of similar nature. Cauda dark, sclerotic, much broader than its length, bearing 8-9 hairs. Legs pale with femora little dusky tibiae and tarsi with spinulose striae ; hairs on tibiae long and fine, those on hind tibiae as long as or little longer than width at the middle of hind tibiae ; dorsoapical hairs on second tarsal segments expanded at apices. Wings little dusky ; forewings with anal vein thicker and darker than other veins ; hind wings with both oblique.

Colour : Dark in life and partly pale abdomen.

Measurements in mm :

	Length	Width	Antenna	
1.	1.9	0.84	0.83	
2.	2.0	0.86	0.84	
	Antennal segments			urs
	III	IV	V	ht ₂
	0.29	0.20	0.16	0.07
	0.30	0.20	0.16	0.07
				0.06
				0.06

(1, 2 ex *Litsaea polyantha*, Kameshi Forest, Darjeeling district, West Bengal, 5. I. 1971, C. U. Colls.).

Other morph : Not available.

Material examined : 5 apterous aliencolae from *Litsaea polyantha*, Mongbul, Darjeeling district, West Bengal, India, 20.x. 1970, Coll. M. R. Ghosh (Holotype and Paratypes ; C. U. Colls.) ; 2 alate viviparous females from *Litsaea corymoba*, Kalimpong, West Bengal, India, 21. II. 1969, (Paratypes ; C. U. Colls.) ; 5 apterous aliencolae from *Litsaea polyantha*, Kalimpong, West Bengal, India, 23. III. 1971 (C.U. Colls.) ; 11 apterous aliencolae from *Lindera* sp., Kaziranga, Assam, India, 27. XII. 1972, Coll. A. K. Ghosh, (Z.S.I. Colls.) ; 3 apterous aliencolae from *Lindera*, Nongthukang, Manipur, India, 16. III. 1974, Coll. K. R. Rao, (Z.S.I. Colls.).

Discussion : The species comes close to *N. machiliphaga* (Takahashi) but can be separated by the characters, as denoted in the key. The species infests leaves and stems of plants of Lauraceae (*Litsaea*, *Machilas*, *Lindera* sp.) and occurs both in the plains and hills upto c 1300 mm, during the months of October to April in Eastern India.

Distribution : India ; West Bengal, Assam, Manipur.

Types : In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India.

28. *Nipponaphis* (*Pseudonipponaphis*) *machiliphaga* Takahashi (Figs. 197-200)

- 1959. *Nipponaphis machiliphaga* Takahashi, R., *Akitu*, 8 : 41.
- 1973. *Nipponaphis* (*Pseudonipponaphis*) *machiliphaga*, Ghosh, A. K., Raychaudhuri, D. N., *Kontyu*, 41 (4) : 484.
- 1976. *Nipponaphis* (*Pseudonipponaphis*) *machiliphaga*, Eastop, V. F. and Hille Ris Lambers, D., *Survey of the World's Aphids*, 322.
- 1980. *Nipponaphis* (*Pseudonipponaphis*) *machiliphaga*, Raychaudhuri, D. N. Ghosh, M. R., Pal, P. K., Ghosh, A. K., *In Aphids of North East India and Bhutan*, 387.

Apterous viviparous female : Body 0.80-1.0 mm long (usually 0.95-0.97 mm long) with 0.75-0.82 mm as maximum width. Antennae 3-segmented, pale, 0.13-0.14 mm long, nearly smooth ; segment III with rhinaria placed wide apart. Eyes of 3 facets. Ultimate rostral segment 0.04-0.05 mm long, obtuse, subequal

to the second segment of hind tarsus. Prosoma defined ; dorsum with oval or subcircular to rounded papillae ; papillae around spiracles somewhat smaller, semicircular ; hairs on the dorsum of prosoma arranged in pair, thick, acute at apices, 0.010-0.015 mm long, $4.5-5.0\times$ as long as the basal diameter of antennal segment III ; lateral hairs on prosoma duplicated, sometimes triplicated, of similar nature and upto 0.163 mm long ; marginal hairs on perpendicular area, much thinner and fine, 0.040-0.053 mm long. Abdominal segments (2-7) fused, pale, bearing 6 pairs of submarginal hairs, of which 1st, 2nd, 3rd and 6th pair thick, 0.130-0.163 mm long, while 4th and 5th pair upto 0.066 mm long. 8th tergite with 4 hairs of which the inner ones 0.130-0.134 mm long and the outer ones 0.054-0.056 mm long. Siphunculi small. Cauda slightly constricted at base, much broader than long, with 6-8 fine hairs. Anal plate bilobed, with 5-6 long, fine hairs on each lobe. Legs pale ; tibial hairs sparse, on hind tibiae upto 0.03-0.04 mm long, $1.2\times$ as long as the width at the middle of the tibiae ; tarsi 2 segmented ; dorso-apical hairs on 2nd tarsal segment as long as the segment.

Colour : Reddish brown in life.

Measurements in mm :

	Length		Width	Antenna
1.	0.96		0.76	0.13
2.	0.96		0.82	0.13
3.	1.0		0.82	0.14

Antennal segments			urs	ht ₂
I	II	III		
0.02	0.03	0.08	0.040	0.050
0.02	0.03	0.08	0.043	0.046
0.02	0.03	0.09	0.044	0.051

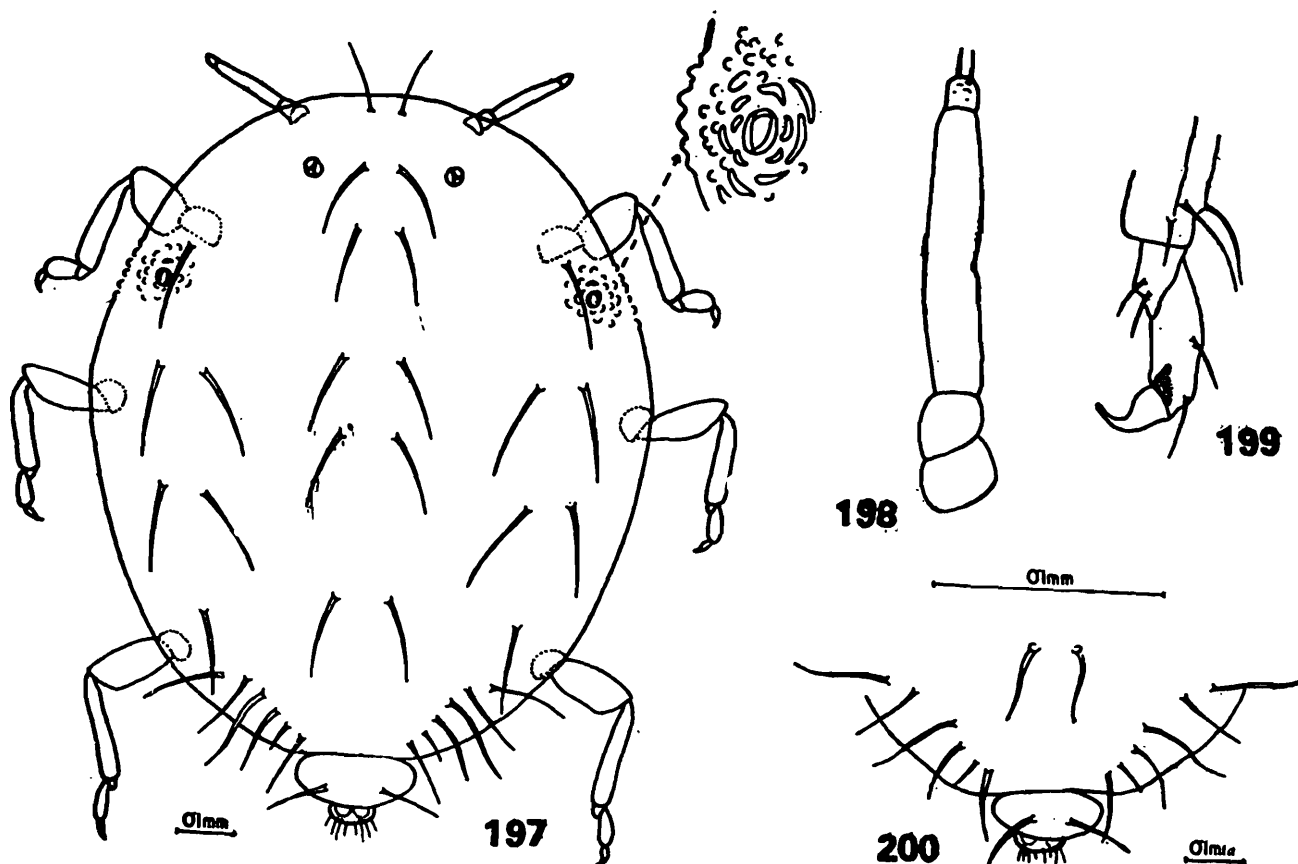
(1, 2 ex *Litsaea polyantha*, Titabar, Assam, 9. xi. 1969, C. U. Coll. ; 3, ex *Litsaea* sp., Garampani, Meghalaya, 26. i. 1975, Z.S.I. Colls.).

Nymph (Apterous) : Body pale 0.82 mm long with head dusky. Dorsal chaetotaxy similar to the adult aliencolae. Prosoma not defined from fused abdominal segments. Dorsal papillae absent. Siphunculi pore like. Legs pale, stout.

Measurements in mm : Length 0.82 ; width 0.58 ; Antenna 0.15 ; u.r.s. 0.08 ; ht_2 0.056 ; dorsal hairs 0.08-0.09 ; lateral hairs 0.11-0.13 ; submarginal hair on abdomen (2, 3, 4, 7) 0.07-0.09, (5, 6) 0.05 ; on 8th ; 0.3-0.4.

Other morphs : Not known.

Material examined : Four apterous aliencolae from *Litsaea polyantha*, Titabar, Assam, India, 9.xi.1969, coll. H. Banerjee ; 2 apterous aliencolae and 2 nymphs, from *Litsaea polyantha*, Tashiding, Darjeeling district, West Bengal, India, 7.iv.1970, Coll. M. R. Ghosh (C.U. Colls.) ; 7 apterous aliencolae from *Litsaea* sp.,



Nipponaphis (P.) machiliphaga Takahashi. Apterous viviparous female : 197, whole body ; 198, antenna ; 199, hind tarsus ; 200, caudal region.

Garampani, Meghalaya, India, 26.i.1975, coll. A. K. Ghosh (Z.S.I. Colls.).

Discussion : The species was described by Takahashi (1959) from *Machilus* sp., in Japan under *Nipponaphis* ; Ghosh and Raychaudhuri (1978) subsequently designated this species as type for their subgenus *Pseudonipponaphis*. The specimens from Indian region fairly agree with Japanese material except that the papillae on dorsum of prosoma is not as dense as in the latter. It is also interesting to note that the specimens in India have not been collected on *Machilus* but always on *Litsaea*. The available records indicate its occurrence from September to April in Eastern India. This species infests under surface of leaves and from small colonies.

Distribution : INDIA : West Bengal, Assam, Meghalaya ; Japan.

Types : Takahashi (1959) mentioned that types are deposited in his collection ; it is likely that subsequently it has been deposited in the collections of Entomological Institute. Faculty of Agriculture, Hokkaido University, Japan as per information of C. Watanabe (1965 : *Ins. matsum.*, 27 (2) : 99).

29. *Nipponaphis manoji* Ghosh and Raychaudhuri (Figs. 201-218)

- 1973. *Nipponaphis manoji* Ghosh, A. K., Raychaudhuri, D. N., *Kontyu*, 41 (4) : 481.
- 1976. *Nipponaphis manoji*, Eastop, V. F., and Hille Ris Lambers, D., Survey of the World's Aphids, 322.
- 1980. *Nipponaphis manoji*, Raychaudhuri, D. N., Ghosh, M. R., Pal, P. K., Ghosh, A. K., *In* Aphids of North East India and Bhutan, 386.

Apterous viviparous female : Body subcircular, dark brown, flattened, 1.2-1.4 mm long. Antennae short, slender, about $1.2\times$ as long as hind tibiae, segment II with 2 hairs, 0.016 mm long ; segment III imbricated ; segment IV distinct and longer than hind tarsus ; distinct between antennae $0.70\times$ as long as the length of antennae. Ultimate rostral segment about $1.6-1.7\times$ as long as second segment of hind tarsus. Prosoma covered with semioval to nearly polygonal pustules, those around thoracic spiracles smaller and somewhat elongate ; submedian muskelplatten

depressed, prominent, about 4 pustules wide ; dorsal hairs long, fine usually duplicated on each of the segment comprising prosoma, nearly $4.0\times$ as long as the diameter at the middle of antennal segment III ; a pair of posteromesial hairs present near hind end of prosoma. Abdominal segments (2-7) fused, defined from prosoma, bearing indistinct papillae and 6 pairs of long submarginal hairs of which 4th and 5th pair distinctly shorter than the others (0.05-0.07 mm) ; a pair of posteromesial hairs present on 7th tergite, 8th abdominal tergite darker than rest of the body, somewhat striate but without any pustules and bears 4 long hairs on hind margin. Siphunculi small, poriform but distinct. Cauda constricted at base, nearly twice as broad as long, with 5-6 hairs of which apical pair longer than the others. Anal plate bilobed, with 6 long hairs on each lobe. Legs pale ; tibiae with long fine hairs, usually $1.0\times$, a few upto $2.0\times$ as long as the width at the middle of the tibia ; tarsi 2-segmented ; first tarsal segments with 3, 3, 2 hairs.

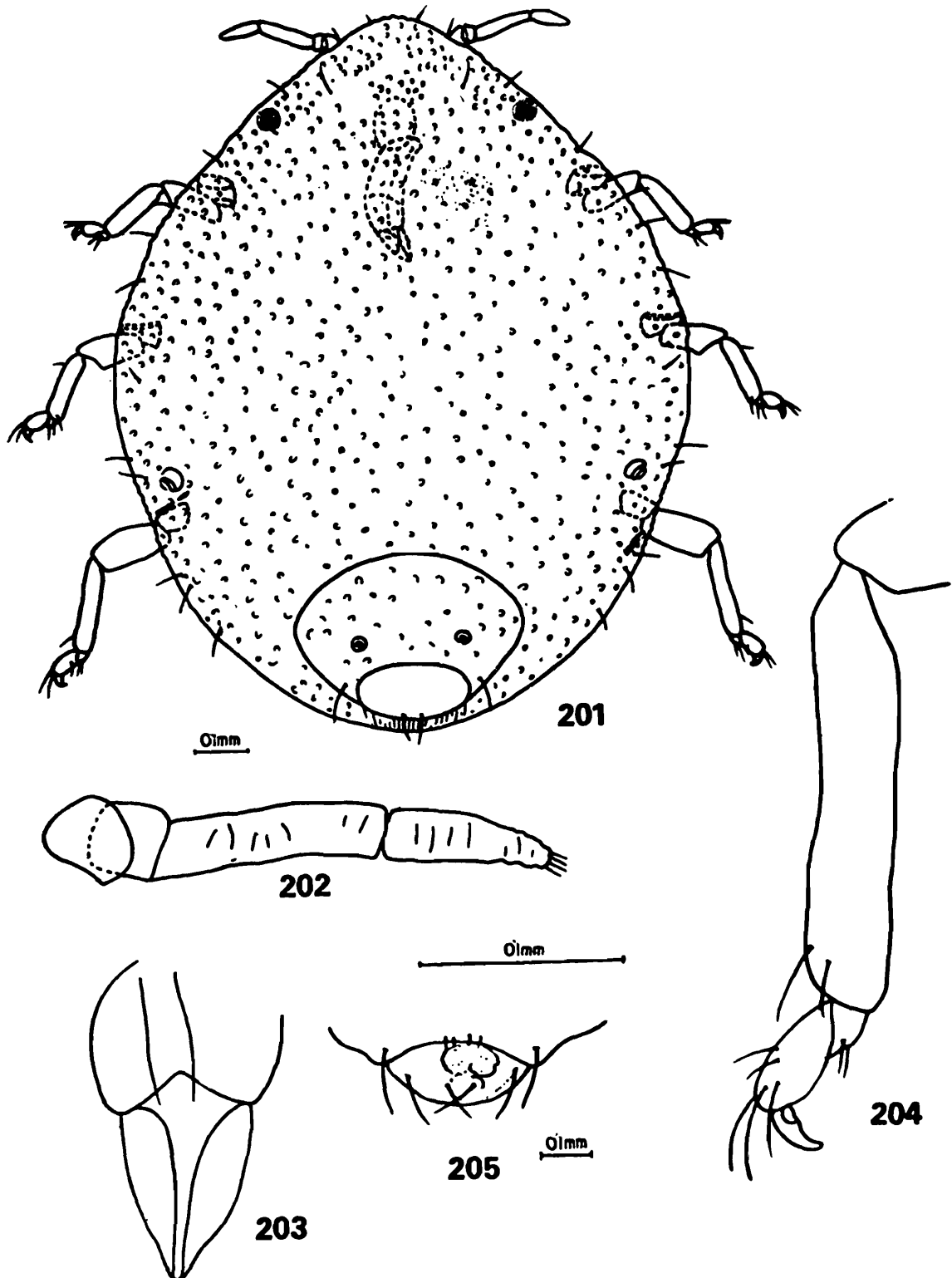
Colour : Brown, in life.

Measurements in mm :

	Length		Width	Antenna	
1.	1.38		1.20	0.24	
2.	1.40		1.25	0.23	
	Antennal segments				
	I	II	III	IV	urs. ht ₂
	0.03	0.04	0.09	0.08	0.10 0.06
	0.03	0.03	0.010	0.07	0.10 0.06

(1, 2 ex *Litsaea polyantha*, Mongbul, West Bengal, 20.x.1970, C. U. Colls.).

Alate viviparous female : Body 1.7-1.9 mm long with 0.80-0.83 mm as maximum width. Head with 12-14 hairs on dorsum, 0.05-0.066 mm long, $3.0-5.0\times$ as long as the basal diameter of antennal segment III. Antennae dark, stout, 5-segmented, 0.38-



Nipponaphis manoji A. K. Ghosh & Raychaudhuri. Apterous viviparous female : 201, whole body ; 202, antenna ; 203, ultimate rostral segment ; 204, part of hind leg ; 205, caudal region.

0.40 as long as the body ; segment II distinctly wrinkled ; segment III with 28-30, IV with 12-15 and V with 8-12 annular secondary rhinaria ; hairs on antennae hardly discernible one on segment III, 0.020 mm long. Ultimate rostral segment $1-1.2\times$ as long as second segment of hind tarsus and longer than antennal segment V. Abdominal dorsum pale except at spiracular plates and marginal sclerites at bases of hairs on 4th-7th tergites, and whole of 8th tergite, which are dark ; 7th and 8th tergite each with 4 hairs (0.100 mm) which are about $6.0\times$ as long as the basal diameter of antennal segment III ; marginal hairs 0.100-0.115 mm long, present one on each side on 1st-7th tergites ; 4 pairs of spiracles present on abdomen. Siphunculi on dark sclerotic bases which appear wrinkled. Cauda with 8-9 hairs. Legs pale to dusky, tibiae imbricated, with bluntly dentate striae ; hairs on tibiae much longer than the diameter at the middle of the tibia. Wing dusky ; forewings with pterostigma and other veins dark brown, anal vein distinct thicker than cubitus ; hind wings with both obliques.

Colour : Dark brown in life, with abdomen partly pale, in life.

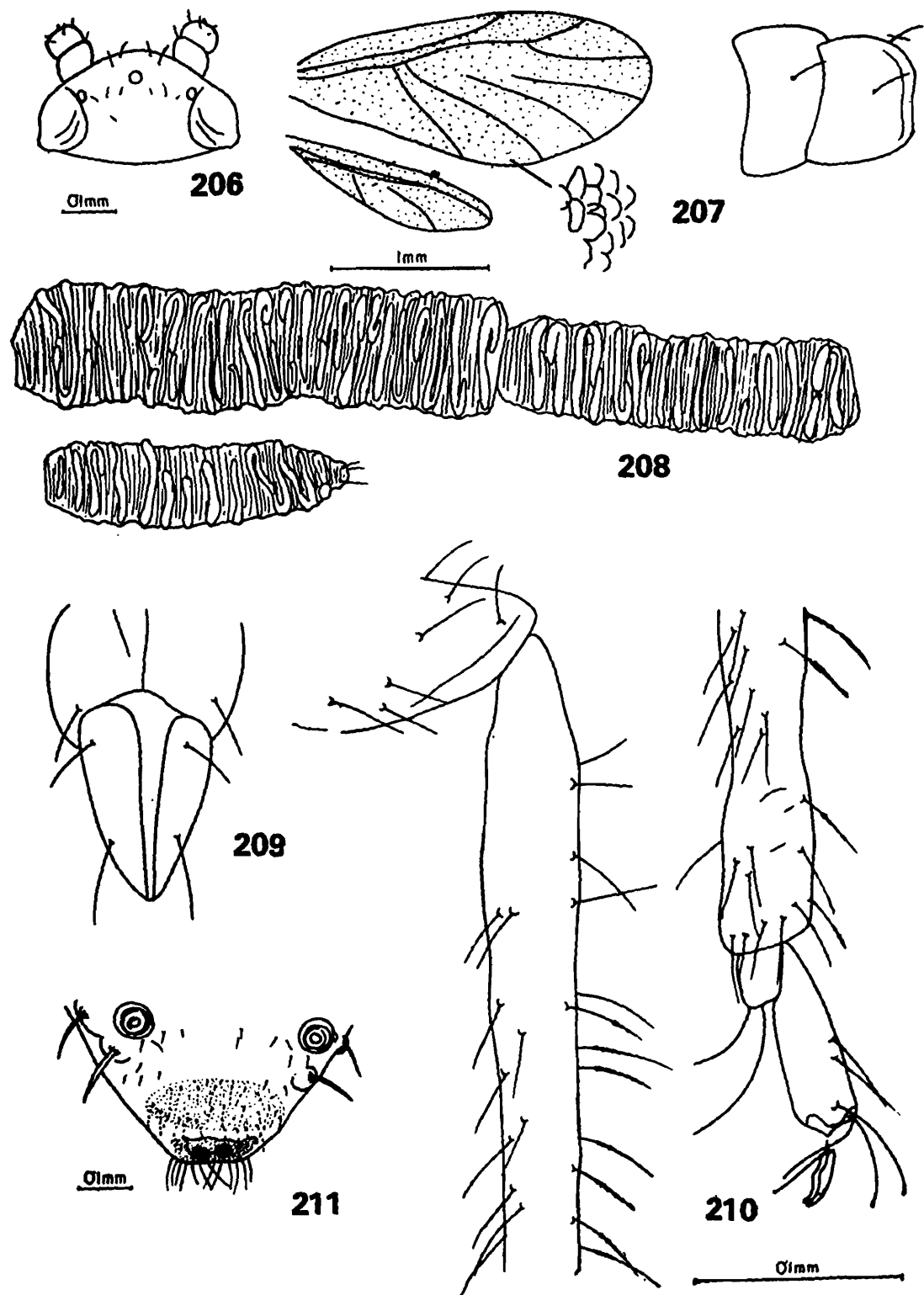
Measurements in mm :

	Length	Width	Antenna
1.	1.80	0.83	0.69
2.	1.85	0.82	0.71

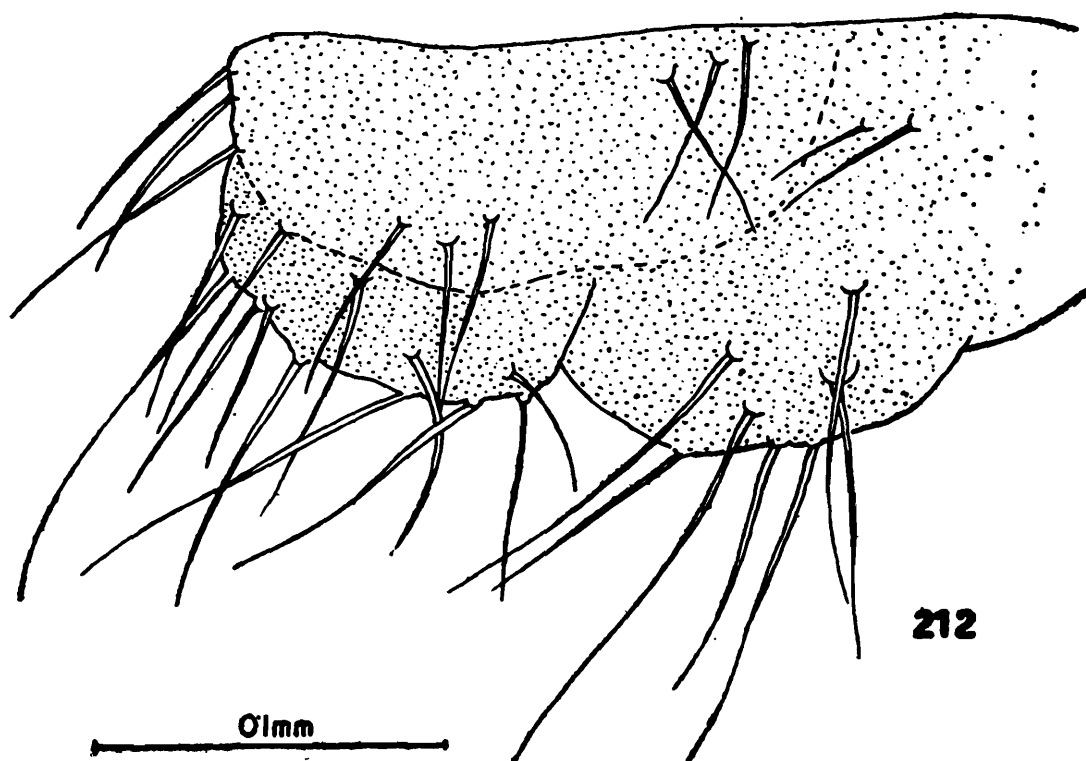
Antennal segments			urs.	ht ₂
III	IV	V		
0.28	0.18	0.14	0.11	0.13
0.27	0.19	0.15	0.10	0.11

(1, 2 ex *Litsaea corymbosa*, Kalimpong, West Bengal, 21.ii.1969, C. U. Colls.).

Alate Nymph : Body large, 2.10 mm long. Head brown faintly scabrous over dorso-lateral side ; dorsal cephalic hairs stiff, acute upto 0.083-0.100 mm long. Antennae stout, 5-segmented, all



Alate viviparous female : 206, head ; 207, wings ; 208, antenna ; 209, ultimate rostral segment ; 210, part of hind leg ; 211, posterior portion of abdomen.



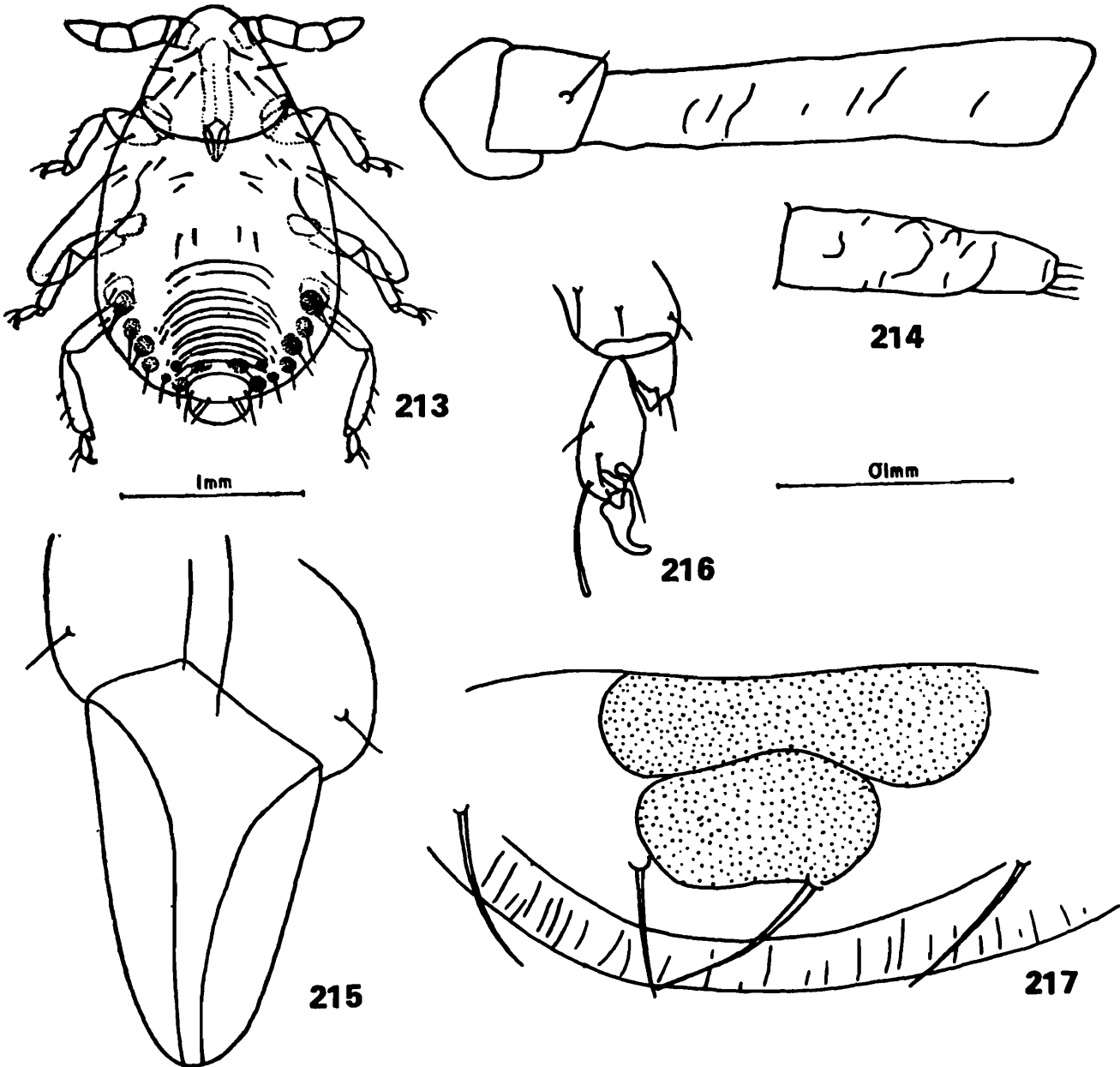
Alate viviparous female : 212, caudal region.

flagellar segments with annular secondary rhinaria distributed over entire length. Thoracic tergum scabrous, with small dentate papilla-like structure. Rostrum reaches little beyond fore coxae ; ultimate rostral segment dark, equal to the second segment of hind tarsus (0.106 mm) and with 4 preapical hairs. Tergum pale yellow bearing paired spinal sclerites on pro-meso-meta nota and on abdomen but these becoming transverse band, like towards caudad ; marginal hairs duplicated on each side of head and thoracic segments, single on abdominal segments mostly arising from large, tuberculate sclerotic bases ; all marginal hairs thick and with acute apices, on head 0.033 mm long, on thoracic segments 0.040-0.050 mm long and on abdominal tergites 0.050-0.060 mm long ; 8th tergite sclerotic dark with 2 marginal and 2 spinal hairs. Siphunculi pore, like surrounded by thick rim. Legs short, stout bearing some fine hairs (0.036-0.073 mm) longest one on hind tibiae upto 0.083 mm long ; $1.3\times$ as long as the diameter at the middle of hind tibia.

Colour : Brown in life.

Measurements in mm :

			Length	Width	Antenna
			2.10	1.07	0.52
Antennal segments					
III	IV	V	urs.	ht ₂	
0.14	0.13	0.13	0.106	0.106	

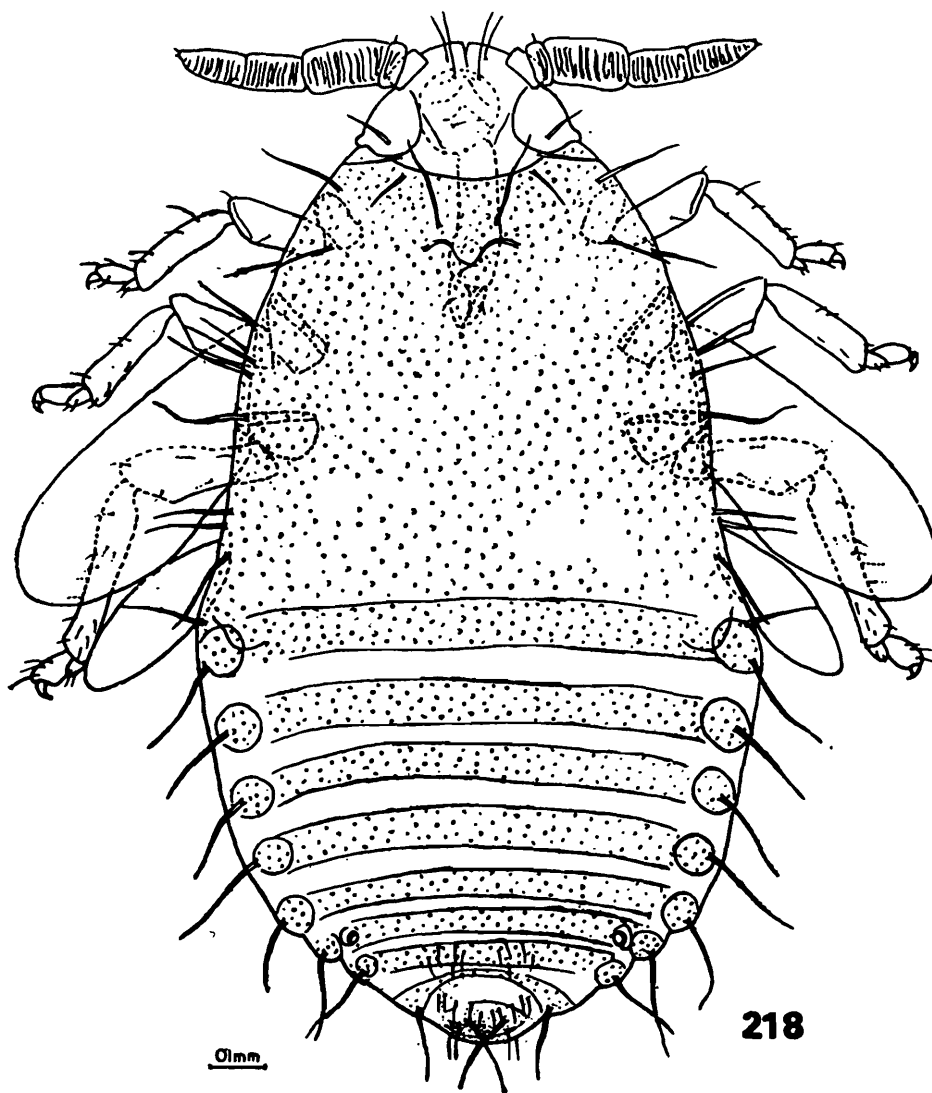


Alate nymph : 213, whole body ; 214, antenna, 215, ultimate rostral segment ;
216, hind tarsus ; 217, caudal region.

(ex *Litsaea corymbosa*, Kalimpong, West Bengal, 21.ii.1969, C. U. Colls.).

Material examined : 12 apterous alienicolae from *Litsaea polyantha*, Mongbul, Darjeeling district, West Bengal, India, 20.x. 1970, 3 apterae alienicolae, 4 alate viviparous females and 3 alate nymphs, Kalimpong, West Bengal, India, 21. ii. 1969 from *Litsaea corymbosa*, Colls. M. R. Ghosh (Types : C.U. Colls).

Discussion : The species can be confused with *Nipponaphis macholicola* (Takahashi) (Ghosh *et al.*, 1971) but can be separated from the former by the absence of submedian hairs, shorter submarginal hairs on 4th and 5th tergites, duplicated hairs on dorsum



Alate nymph (late state) : 218, whole body.

of prosoma and in having papillae around spiracles not pointed at tips. This species infests both leaves and young stems and is usually attended by ants.

Distribution : India, West Bengal.

Types : In the collections of Entomology Laboratory Department of Zoology, University of Calcutta, India.

30. *Nipponaphis* (*Pseudonipponaphis*) *querciphaga*

Ghosh and Raychaudhuri

(Figs. 219-223)

1973. *Nipponaphis* (*Pseudonipponaphis*) *querciphaga* Ghosh, A. K., and Raychaudhuri, D. N., *Kontyu*, **41** (4) : 484.
 1976. *Nipponaphis* (*Pseudonipponaphis*) *querciphaga*, Eastop, V. F. and Hille Ris Lambers, D., *Survey of the Worlds' Aphids*, 322.
 1977. *Nipponaphis querciphaga*, Miyazaki, M., *Kontyu*, **45** (2) : 211.
 1980. *Nipponaphis* (*Pseudonipponaphis*) *querciphaga*, Raychaudhuri, D. N., Ghosh, M. R., Pal, P. K., Ghosh, A. K., *In* *Aphids of North East India and Bhutan*, 387.

Apterous viviparous female : Body 1.3-1.6 mm long with 1.0-1.2 mm as maximum width, yellowish to brown in colour. Antennae 3-(4) segmented, equal to the length of the hind tibia, the distance between antennae about $0.80 \times$ as long as the length of antenna ; rhinaria on segment III placed wide apart. Ultimate rostral segment long, distinct, $1.6-2.0 \times$ as long as second segment of hind tarsus. Prosoma nearly smooth except around thoracic spiracles which are surrounded by semi-oval protruberant pustules ; similar pustules can also be evidenced in posterior part of prosoma ; hairs on the dorsum of prosoma 0.06-0.09 mm (0.12-0.15 mm) long, acute at apices, sometimes bifurcated, arising from conspicuous bases, arranged along mid-dorsal line and submarginal region, $0.33-0.50 \times$ as long as the antenna ; marginal hairs on lateral perpendicular area sparse and somewhat thinner, almost similar in length to the dorsal hairs ; posteromesial hair on hind end of prosoma absent. Abdominal segments (2-7) fused, appear to be separated from prosoma by a transverse pale membranous furrow and bear 6 pairs of submarginal hairs, (0.07 mm-0.10 mm long) and a pair of posterimesial hairs on 7th tergite ; 8th tergite with 4 thick hairs

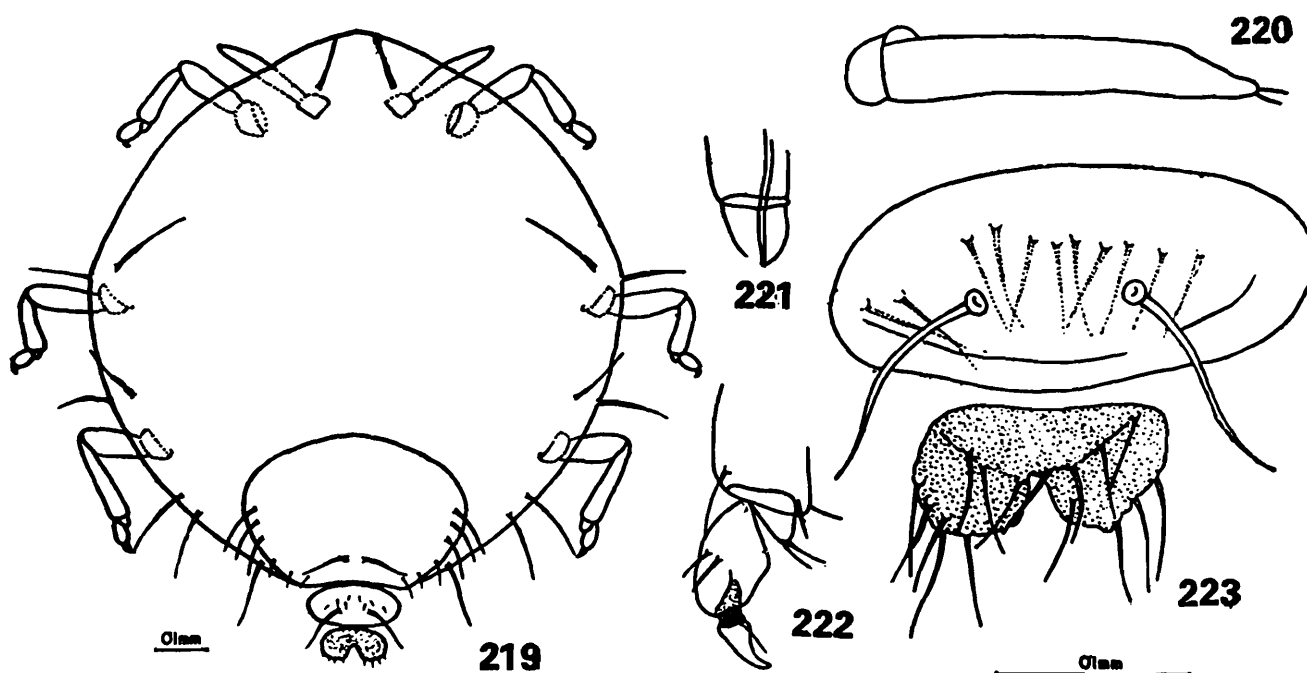
of similar length which are about $0.33\times$ as long as the antenna. Siphunculi small, pore-like. Cauda dark sclerotic with 7-8 (10) long hairs. Anal plate bilobed, each lobe with 4 long (7) hairs. Legs pale, tarsi 2-segmented and claws normal, hairs on tibiae stiff, longest one about $1.2\times$ as long as the width at the middle of hind tibia, first tarsal segments with 3, 3, 2 hairs (figures in parenthesis from Miyazaki, 1977).

Colour : Dark brown in life.

Measurements in mm :

	Length	Width	Antenna		
1.	1.4	1.0	0.20		
2.	1.6	1.20	0.23		
	Antennal segments				
	I	II	III	IV	
	0.02	0.03	0.15		urs
	0.02	0.00	0.12	0.06	ht ₂
					0.10
					0.13
					0.06
					0.07

(1, 2, ex. *Quercus* sp., Jamlingaon, Sikkim, 29.iii.1970, C.U. Colls.).



Nipponaphis querciphaga A. K. Ghosh & Raychaudhuri. Apterous viviparous female : 219, whole body ; 220, antenna ; 221, ultimate rostral segment ; 222, hind tarsus ; 223, caudal region.

Miyazaki (1977) provided description of 3rd and 4th instar nymphs from Nepal, as follows :

Nymphs : (Third instar ; apterous) : Body 0.8 mm long. Head sclerotised on spino-pleural areas with pale brown weakly warty dorsum ; remaining part of prosoma pale and membranous excepts sclerites at bases of dorsal hairs and intersegmental aerolations ; mesothorax with one ventral hair placed posteriorly to each spiracle ; marginal tubercles variably present on some basal sclerites of marginal hairs. Abdominal 12-7 × shield (2-7), retain traces of segmentation, specially 2nd segment is defined from the rest by a narrow membranous suture ; 8th segment sclerotic, clearly defined ; dorsal hairs on prosoma and abdomen as in adult. Cauda with 4 hairs.

Nymph : (Fourth instar ; apterous). Body 0.9-1.10 mm long. Mesothorax with 3 ventral hairs, posteriorly to each spiracle. Abdominal shield sclerotized, more or less distinct from prosoma and bears some tubercles placed dorsally to marginal hairs. Dorsal hairs long, stout, pointed, arranged as in adult. First tarsal segments with 3, 3, 2 hairs. Otherwise similar to 3rd instar.

Other morphs : Not known.

Material examined : 6 apterous aliencolae and 4 nymphs from *Quercus* sp., Jamlingaon (c 300 m), Sikkim, India, 29.iii.1970, Coll. H. Banerjee (Types ; C. U. Colls) : 2 apterous aliencolae from *Quercus* sp., Chubba (c 650 m), Sikkim, India, 12.iii.1970, Coll. M. R. Ghosh, (C. U. Colls.).

Discussion : The species comes close to *himalayensis* but can be separated by the characters used in the key, and also by its host plant association. Originally described from Sikkim, the species was subsequently redescribed from specimens collected in Nepal and it appears to be another species restricted to Himalayan region of the subcontinent. The specimens from Nepal, however, differ from the specimens from Sikkim in having 4-segmented antennae, longer dorsal hair on prosoma and fused abdominal segments, more hairs on cauda and lobes of anal plate and has only been recorded

from *Castanopsis* sp., in both the areas, this species has been noted to occur during the months of March and April.

Distribution : INDIA, Sikkim ; Nepal.

Types : In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India.

Genus 10. *Parathoracaphis* Takahashi, 1958

1958. *Parathoracaphis* Takahashi, R. *Ins. matsum*, 22 : 13 ; Ghosh, A. K. and Raychaudhuri, D. N. 1973, *Kontyu*, 41 (4) : 486 ; Eastop, V. F. and Hille Ris Lambers, D. 1976 Survey of the World's Aphids, 336. Type species : *Thoracaphis setigera* Takahashi.
1983. *Hoplothoracaphis* Pramanick, D. R., Samanta, A. K., Raychaudhuri, D., *Akitu*, 57 : 1. Type species : *Hoplothoracaphis manipurens* Pramanick, Samanta, Raychaudhuri.
- Type species : *Hoplothoracaphis manipurens* Pramanick, Samanta, Raychaudhuri.

Morphology : Body flat, 0.50-1.0 mm long, depressed, narrow elongate or broadly semioval, sclerotized. Prosoma completely consolidated with abdominal segment (2-7), which may be completely fused or partly defined. Tergum in apterae may be reticulated, corrugated, convoluted or with wax-pores. Antennae placed ventrally, may be hardly discernible or well developed with 2 or 3-4-segments. Eyes of 3 facets in apterae. Submarginal hairs distinctly spine-like, thick, total number varying between 28-32 including the ones on frons, sometimes arising from tuberculate bases ; submedian hairs minute or fine and shorter or longer than the marginal hairs. Marginal area of venter defined. 8th tergite with 2-4 spines similar to submarginal spines. Siphunculi absent or not discernible. Cauda small, wider than long, with a basal constriction and with many fine hairs. Subanal plate deeply bilobed with many fine hairs. Subgenital plate, large, rounded on hind margin. Legs black, concealed under the body, hind tibiae as long as or longer than femora ; tarsi small, usually two-segmented except in *elongatus* ; claws small, normal or absent ; first tarsal segments usually with 2-3 hairs. Alatae unknown.

Discussion : Takahashi (1958) described the genus *Parathoracaphis* with *Thoracaphis setigera* Takahashi 1932, as its type-species. The genus was characterised by consolidated cephalothorax and abdominal segments 1-7, presence of spine like sub-marginal hairs and absence of siphunculi ; besides *setigera* Takahashi (op. cit) suggested inclusion of *Thoracaphis kayashimai* Takahashi 1950, from Malaya and *T. elongata* Takahashi 1941, from Thailand, to this genus. Eastop and Hille Ris Lambers (1976) also included *Thoracaphis cheni* Takahashi 1936, *T. gooti* Takahashi 1950, under this genus. Thus, a total of five species were known under *Parathoracaphis*. A review of morphological characters of these 5 species indicates wide spread variations viz. antennae not discernible (*elongata*), 2 segmented (*setigera*), 3-4 segmented (*gooti*) ; dorsum may be reticulated (*setigera*), without reticulation (*kayashimai*), corrugated (*gooti*) ; tarsi may be unsegmented (*elongata*) to 2-segmented (*setigera* and *gooti*) ; however all the five species agree in the absence of siphunculi, Takahashi (1959) described another genus *Lithoaphis* and *Lithoaphis shiiae* n. sp. as type from Japan and characterised the genus by strongly sclerotised dorsum in aptera, having irregular translucent parts, short antennae with indistinct segmentation and by the presence of siphunculi.

Eastop and Hille Ris Lambers (1976) included a second species *Astegopteryx lithocarpi* Takahashi, 1929 from Formosa, under *Lithoaphis*. However, *shiiae*, appears to differ distinctly in the absence of setae, like marginal hairs from *lithocarpi* and in having 6 hairs on 8th tergites as against two, in *lithocarpi*.

Takahashi (1950), while describing *T. gooti* from Malaya, indicated resemblance of *gooti* and *lithocarpi* but separated the former by 4 spines on 8th tergite (as against 2 in *lithocarpi*), longer median hairs than submarginal hairs (as against shorter ones in *lithocarpi*), and shape of body ; he, however did not mention about absence of siphunculi in *gooti* and its presence in *lithocarpi*.

Pramanick, D. R., et al. (1983), described a new genus *Hoplothoracaphis* with a new species *manipurensis* from Manipur, India. The same species has also been collected by this author in Manipur on *Castanopsis* ; the type-species shows very close affinity with *Parathoracaphis* in presence of submarginal hairs, sclerotised dorsum,

consolidated cephalothorax and abdomen and the latter with siphunculi and as such *Hoplothoracaphis* is treated here as a complete synonym of *Parathoracaphis* ; however *manipurensis* does not agree with any of the 5 species known under *Parathoracaphis* and appears to share characters of *gooti* and *lithocarpi*. It agrees with *L. lithocarpi* in its shape of body, distribution of sub marginal hairs, ratio of length of sub marginal hairs and median ones, ratio of hind femora to hind tibia, arrangement of frontal hairs etc. ; in the absence of siphunculi and number of setae on 8th tergite, it agrees with *P. gooti* but considering absence of siphunculi as a major character, the specimens from India, is treated under *Parathoracaphis*, but because of peculiar assemblage of characters it has been kept as a separate species. As such the genus is now considered to be composed of 6 species.

Biology : Most of the species of *Parathoracaphis* have *Fagaceae* as hosts (*Quercus*, *Lithocarpus* and *Castanopsis*); in case of the record of *P. manipurensis* (Raychaudhuri, D. *et al.*) from *Lauraceae* (*Litsaea*) is considered authentic, then the host range covers *Magnolidae* and *Hamamelidae*, a common phenomenon for many *Hormaphidinae* which is suggestive of possible host alternation. Usually, the members of this genus infest lower surface of leaves of host plant in large number (mostly apterae viviparae) during winter months ; some species like *setigera* has been reported to be common in Japan throughout the year. Myrmecophily is not common but *manipurensis* is reported to be visited by red ants, on *Litsaea* in November.

Distribution : INDIA : Manipur, Nagaland ; CHINA ; MALAYASIA ; THAILAND ; JAPAN.

Types-species : *Thoracaphis setigerus* Takahashi 1932 ; deposited in the collections of Taiwan Agricultural Research Institute.

**31. *Parathoracaphis manipurensis* (Pramanick, Samanta &
Raychaudhuri)
(Figs. 224-226)**

1983. *Hoplothoracaphis manipurensis* Pramanick, D. R., Samanta, A. K., Raychaudhuri, D., *Akitu*, 57 : 2.

Apterous viviparous female : Body brown to black semicircular, 0.75-0.90 mm long (0.88-0.90 mm) with 0.67-0.79 mm (0.67-0.69 mm) as maximum width. Antennae small, hardly discernible, (3-segmented), 0.07-0.08 mm long. Eyes protruberant, of 3 facets. Rostrum short, ultimate rostral segment $0.63-0.81\times$ as long as second segment of hind tarsus. Prosoma and abdominal segments (2-7) fused laterally ; dorsal surface of prosoma wrinkled or corrugated and with 3 pairs of somewhat flattened hair—bearing, tubercle-like structure which are connected by a median-ridge ; a number of somewhat raised translucent wax gland-like structure variably present ; a total of 32 stiff spines, (3 pairs between the eyes, 13 pairs over other areas) each arising from a tuberculate base, present around the margin, these are all projected outward, 0.030-0.036 mm long, about $5.0\times$ as long as wide, and pointed at apices ; dorsal hairs, a total of 5 pairs, are thinner than marginal spines but almost similar in length ; abdominal segments (2-7) somewhat discernible ; 8th tergite completely separated and bears 4 apines. Siphunculi absent. Cauda constricted at base and bears 8-9 hairs. Subanal plate bilobed. Legs short, fore and middle tibiae as long as femora, hind tibiae longer than femora ; tarsi 2-segmented, first tarsal segments with 3, 3, 2 hairs ; claws normal.

Colour : Black in life.

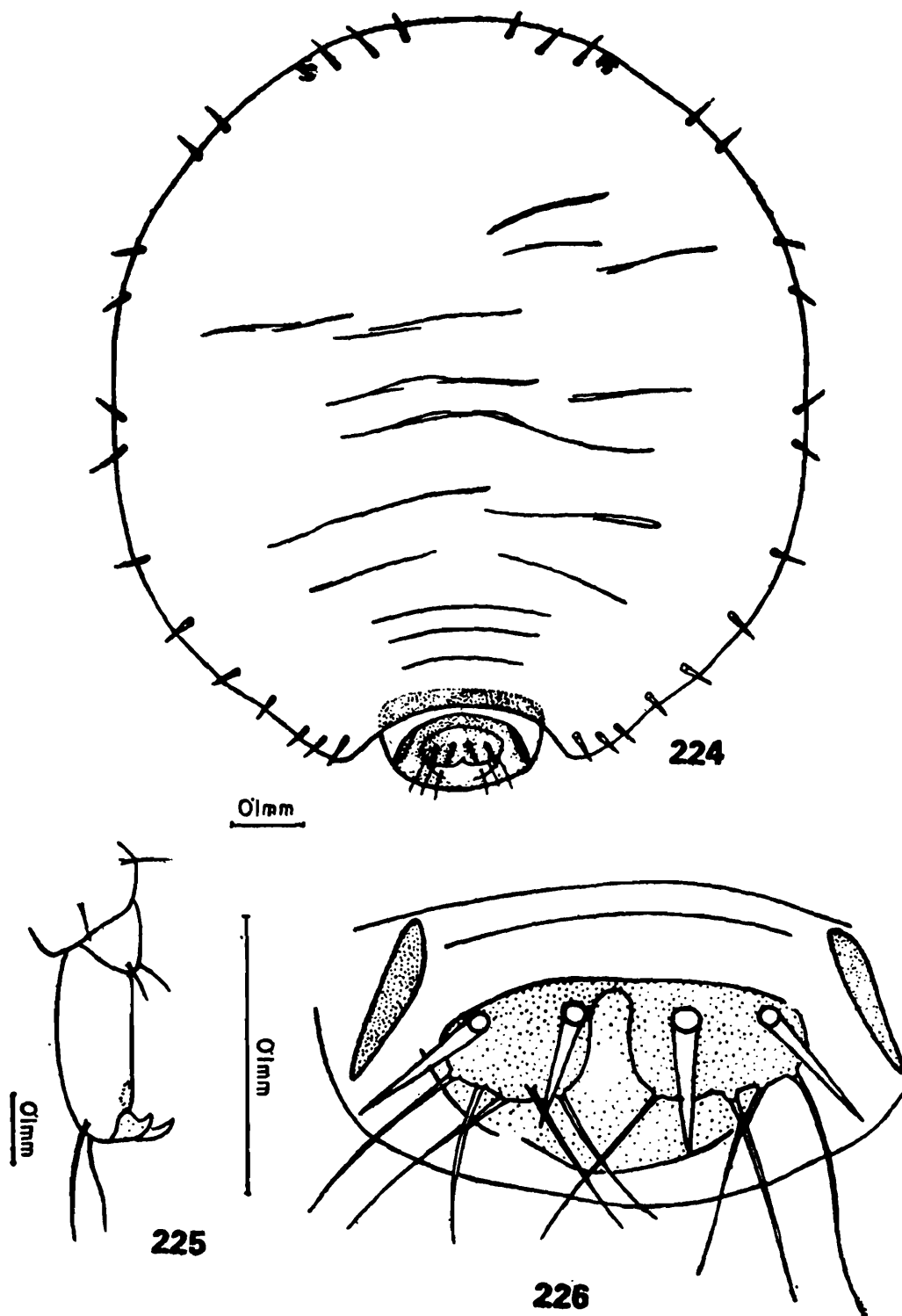
Measurements in mm :

	Length	Width	Antenna	urs	ht ₂
1.	0.81	0.76	0.08	0.026	0.03
2.	0.84	0.75	0.07	0.026	0.03
3.	0.80	0.74	0.06	0.025	0.03
4.	0.08	0.69	0.07	0.030	0.04

(1, 2, 3 ex. *Castanopsis* sp., Keithelmanbi, Manipur, 14.1.1976, Z.S.I Collections, 4 ex. *Litsaea sebifera*, Churachandpur, Manipur, 13.xi.1976, C.U. Colls.).

Fundatrix : Body pale, semivoal, 1.38 mm long with 0.90 mm as maximum width. Head smooth ; dorsal cephalic hairs spine like, dagger-shaped, about equal to the basal diameter of antennal seg.

ment III. Antennae 5-segmented, $0.37\times$ as long as the body ; basal segments smooth, flagellum with more distinct spinulose imbrications from apices of segment III, apicad ; hairs on the flagellum



Parathoracaphis manipuriensis (Pramanick, Samanta, Raychaudhuri), Apterous viviparous female : 224, whole body ; 225, hind tarsus ; 226, caudal region.

long, fine, $1.60 \times$ as long as basal diameter or antennal segment III; processus terminalis $0.28 \times$ as long as base of last antennal segment. Rostrum long, reaches beyond abdominal segment I ; ultimate rostral segment stilleto-shaped, $2.08 \times$ as long as second segment of hind tarsus and bears 2 accessory hairs. Abdominal dorsum pale, smooth, bearing segmentally arranged spine-like hairs, upto 0.010 mm long ; 7th tergite with 6 and 8th tergite with 4 such hairs. Siphunculi on elevated cones. Cauda semilunar, bearing 4 hairs. Legs with normal tarsi and claws ; first tarsal segments with 4, 4, 4 (?) hairs.

Colour : Not recorded.

Measurements in mm :

Length		Width		Antenna	
1.38		0.90		0.51	
Antennal segments		urs		ht ₂	
III	IV	V			
0.21	0.09	0.15	0.19	0.09	

(ex. *Amaranthus* sp., Dimapur, Nagaland, 8.xi.1982, C.U. Colls.).

Other morphs : Not known.

Material examined : 12 apterous aliencolae, from *Castanopsis* sp., Keithelmanbi, Manipur, India, 14.i.1976, Coll. A. K. Ghosh (ZSI Colls.) ; 8 apterous aliencolae, from *Litsaea sebifera*, Chura-chandpur, Manipur, India, 13.xi.1976 ; 6 apterous aliencolae from indet host, Ghaspani, Nagaland, xi.1982 ; one fundatrix from *Amaranthus* sp., Dimapur, Nagaland, India, 8.xi.1982 (C.U. Colls.).

Discussion : The material collected on *Castanopsis* agrees with the specimens collected on *Litsaea* and *Amaranthus* (the latter also includes fundatrix). Pramanick *et al.* (1983) described the species under a new genus *Hoplothoracaphis* and mentioned that this new

genus comes close to *Parathoracaphis* but differs in absence of reticulation, in presence of 2-segmented tarsi and well developed claws besides in the presence of spinal tubercle-like structure. Eastop and Hille Ris Lambers (1976) listed 5 species under *Parathoracaphis*, of which *kayashimi* (Takahashi), *gooti*, (Takahashi), *elongatus* (Takahashi) have no reticulation on dorsum and first two species have well developed tarsi and claws. As such, the present species can very well be included under *Parathoracaphis* but can be separated from all the other 5 species by the large first flat tubercle-like structure on the dorsum of prosoma. All species of *Parathoracaphis* were known from Fagaceae (*Quercus* spp.) and the present species provides two additional host-records (*Litsaea* and *Amaranthus*).

Distribution : INDIA : Manipur ; Nagaland.

Types.—In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India.

Genus 11. *Parathoracaphisella* Pramanick, Samanta and Raychaudhuri, 1983

1983. *Parathoracaphisella* Pramanick, D. R., Samanta, A. K., Raychaudhuri D., *Akitu*, 57 : 4. Type species : *Parathoracaphisella indica* Pramanick, Samanta, Raychaudhuri.

Morphology : Body thick with crenulated submarginal area along entire margin of prosoma and fused abdominal segments (2-7). Antenna short, 2-segmented. Eyes of 3 facets. Dorsum of prosoma smooth, separated from fused abdominal segments (2-7) ; dorsal hairs stiff and blunt ; posteromesial hairs absent ; submarginal area appear crenulated like teeth of a comb, with an entire margin but without any hairs. Abdominal segments (2-7) completely fused with dorso-median mosaic-like sculpturing and rounded papillae or sculpturing over the lateral area ; submarginal hairs, 6 pairs, stout, fine, posteromesial hairs. 8th tergite with 2 (?) hairs. Siphunculi absent. Legs normal, tarsi 2-segmented with normal claws ; first tarsal chaetotaxy 2, 2, 2 ; dorso apical hairs on second tarsal segments expanded at apices.

Discussion : The genus comes close to *Allothoracaphis* Takahashi, but can be separated by the absence of normal submarginal hairs and postero-mesial hairs on fused abdominal segments (2-7) which is clearly separated from prosoma, by very short 2-segmented antennae and absence of any mosaic-like design on prosoma.

Pramanick *et al.* (1983) mentioned about thick spiny submarginal hairs and partially separated abdominal segments (2-7), but examination of paratypes indicates a complete margin with submarginal crenulation appearing like teeth of a comb and matured specimen exhibits clearly defined abdominal segments (2-7).

Biology : No data on biology is available except occurrence of aliencolae on *Quercus* sp., during the month of November.

Distribution : INDIA.

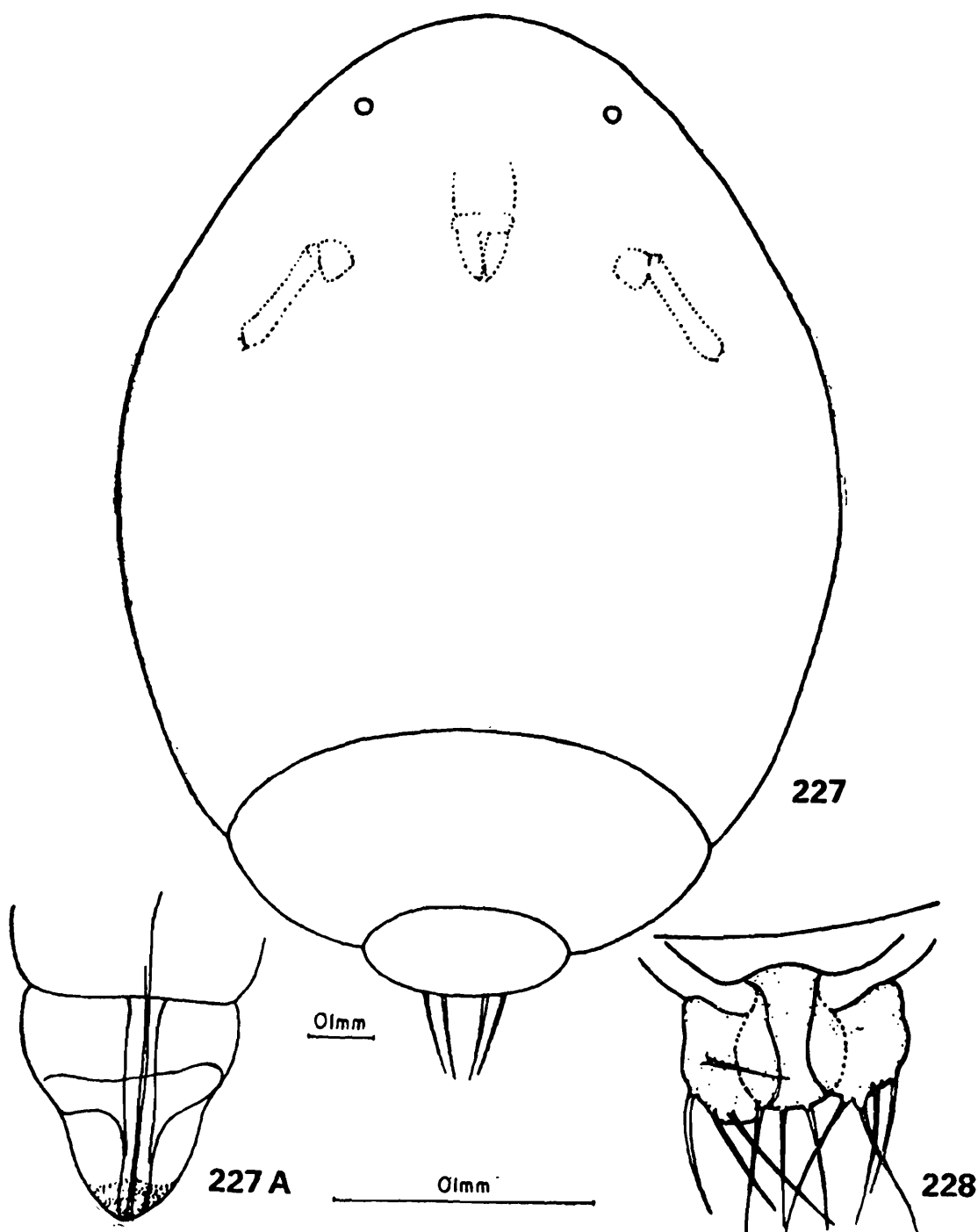
Type species : *Parathoracaphisella indica* Pramanick, Samanta, Raychaudhuri 1983 ; deposited in the collection of Entomology Laboratory, Department of Zoology, University of Calcutta, India.

32. *Parathoracaphisella indica* Pramanick, Samanta and Raychaudhuri (Figs. 227-228)

1983. *Parathoracaphisella indica* Pramanick, D. R., Samanta, A. K., Raychaudhuri, D., *Akitu*, 57 : 4.

Apterous viviparous female : Body dark brown oval, about 1.05-1.12 mm long with 0.66-0.82 mm as maximum width. Antennae 2-segmented, 0.12-0.03 mm long. Eyes of 3 facets. Prosoma laterally free from fused abdominal segments (2-7), smooth over dorsum ; hairs on dorsum of prosoma stiff, acute, 0.01-0.02 mm long ; submarginal hairs thick, spine-like, encircling the entire margin except 8th tergite ; posteromesial hairs absent. Ultimate rostral segment blunt about 0.70 × as long as second segment of hind tarsus and without any accessory hairs. Abdominal segments (2-7) fused and reduced, with mosaic-like sculpturing on mid-dorsal area and rounded papillae on lateral areas ; submarginal hairs 6 on each side, short and fine ; posteromesial hairs fine, 0.01-0.02 mm long. 8th tergite completely defined and bears 2 hairs. Siphunculi absent. Cauda globular bearing few hairs. Subanal plate bilobed, each lobe

with 5-7 very long fine hairs. Legs pale ; tibial hairs sparse, minute, 0.006 mm long, $0.33 \times$ as long as width at the middle of hind tibia; tarsi 2-segmented with normal claws ; first tarsal segments with 2, 2, 2 hairs ; dorso-apical hairs on 2nd tarsal segments expanded at apices.



Parathoracaphisella indica Pramanick, Samanta, Raychaudhuri. Apterous viviparous female : 227, whole body ; 227A, ultimate rostral segment ; 228, caudal region.

Measurements in mm :

	Length	Width	Antenna	urs	ht ₂
1.	1.0	0.72	0.03	0.03	0.04
2.	1.12	0.82	0.03	0.02	0.03
3.	1.15	0.88	0.03	0.03	0.04

(1, 2, 3 ex. *Quercus* sp., Moreh, Manipur, India, 6.xi.1977, C.U. Colls.).

Other morphs : Not known.

Material examined : 6 apterous aliencolae from *Quercus* sp., Moreh, Manipur, India, 6.XI.1977, Coll. D. Raychaudhuri (C.U. Colls.).

Discussion : This species forms the type of monotypic genus, which is separable by characters provided under the genus, from members of allied genera. The species is only recorded from *Quercus* in Northeastern state of Manipur from a locality bordering Burma.

Distribution : INDIA : Manipur.

Types : In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India.

**Genus 12. *Pseudothoracaphis* Raychaudhuri,
Ghosh and Das, 1980**

1980. *Pseudothoracaphis* Raychaudhuri, D. N., Ghosh, L. K., Das, S. K. *Ins. matsum*, 20 : 36. Type species : *Pseudothoracaphis himachali* Raychaudhuri, Ghosh, Das.
1985. *Heminipponaphis* Chakraborti, S., Raha, S. K., *Ann. Zool.*

Morphology : Body semioval, strongly sclerotised. Antennae 3-segmented, hardly 0.10× as long as the body. Eyes of 2 facets. Prosoma dark brown, completely separated from fused abdominal segments 2-7. Rostrum very short, hardly reaching midway to fore coxae ; ultimate rostral segment longer than second segment of hind

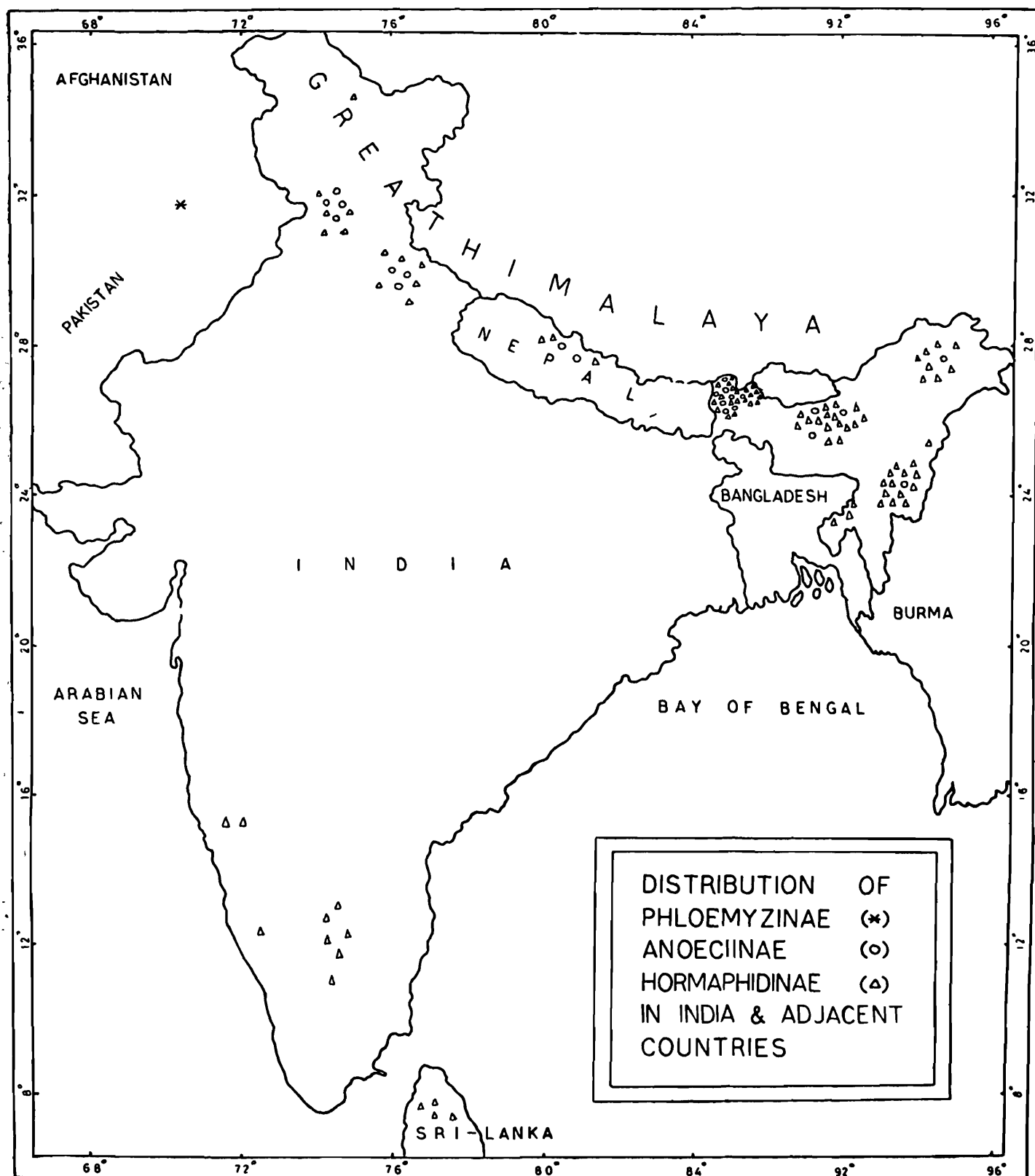
tarsus. Dorsum of prosoma without any tubercle, corrugated or wrinkled, marginally reticulated ; sub-marginal hairs absent on prosoma and abdomen ; posteromesial hairs not discernible. Abdominal dorsum much less wrinkled than prosoma ; 8th tergite with 2 spine-like hairs. Siphunculi absent. Cauda constricted at base. Subanal plate bilobed. Legs normal ; dorso-apical hairs on second tarsal segment with expanded apices ; claws normal. First tarsal segments with 2-3 (?) setae.

Discussion : Raychaudhuri *et al.* (1980) described the new genus with a new species *himachali* from Northwest India and mentioned about its apparent relationship with *Allotheracaphis* Takahashi, following the key to Nipponaphidine genera (Ghosh and Raychaudhuri, 1973). Chakrabarti and Raha (in press) described another new genus *Heminipponaphis* with a new species, *Querciphaga* from adjacent area in Northwest India ; while relationship with *Allothoracaphis* and *Paranipponaphis* Takahashi, following the same key to the genera was again referred, no mention was made to its resemblance to *Pseudothoracaphis* Raychaudhuri *et al.* During the course of present study, type material of both *himachali* (type-species of *Pseudothoracaphis*) and *querciphaga* (type-species of *Heminipponaphis*) were studied, both of which turned out to be the same species ; and as such *Heminipponaphis* with its type *querciphaga* is now considered as complete synonym of *Pseudothoracaphis* with its type *himachali*. This monotypic genus appears closest to *Allothoracaphis* Takahashi but differs from the former as also from many other genera, in the absence of submarginal hairs on prosoma ; In *Neothoracaphis* Takahashi, submarginal hairs may sometimes be absent but it has unsegmented antenna and 4 hairs on 8th tergite.

Biology : The only member of this genus is so far known to be anholocyclic on *Ilex* and *Quercus* and form moderate colonies on the leaves during October-November at higher altitude in Himachal Pradesh, India. No alatae or any other morphs have been collected.

Distribution : INDIA

Type species : *Pseudothoracaphis himachali* Raychaudhuri, Ghosh, Das, 1980 ; deposited in the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India.



33. ***Pseudothoracaphis himachali*** (Raychaudhuri, Ghosh & Das)
(Figs. 229-232)

1980. *Pseudothoracaphis himachali* Raychaudhuri, D. N. Ghosh, L. K. & Das
S. K., *Ins. matsum.*, **20** : 36.
Heminipponaphis querciphaga Chakrabarti, S. & Raha, S.

Aptorous viviparous female : Body 1.20-1.60 mm long with 0.75-1.15 mm as maximum width; margin with indistinct indentation. Antennate 3-segmented, 0.09-0.12 mm long, ventrally placed. Eyes of 2-3 facets. Prosoma completely separated from fused abdominal segments (2-7) ; dorsum of prosoma corrugated and wrinkled, marginally indistinctly reticulated ; submarginal hairs absent ; dorsal hairs minute, hardly discernible. Rostrum short, ultimate rostral segment $1.45-1.55 \times$ as long as second segment of hind tarsus and without any accessory hairs. Abdominal segments (2-7) completely fused, less wrinkled than dorsum of prosoma but bearing scattered groups of small circular wax cell-like structures, both on marginal and spino-pleural region ; submarginal hairs and posteromesial hairs absent ; 8th tergite defined, bearing 2 long, spiny hairs, 0.01-0.02 mm long. Siphunculi absent. Cauda knobbed, wider than long, with a number of fine hairs, Subanal plate bilobed, each lobe with 5-6 hairs. Legs pale ; fore tibiae shorter than femora, middle tibiae as long as femora and hind tibiae distinctly longer than femora, $5.0 \times$ as long as wide and bearing 4-5 hairs at distal end ; tarsi 2-segmented, claws normal ; first tarsal segments with 3, 3, 2 hairs, dorso-apical hairs on second tarsal segments expanded at apices.

Colour : Brown to dark brown in life.

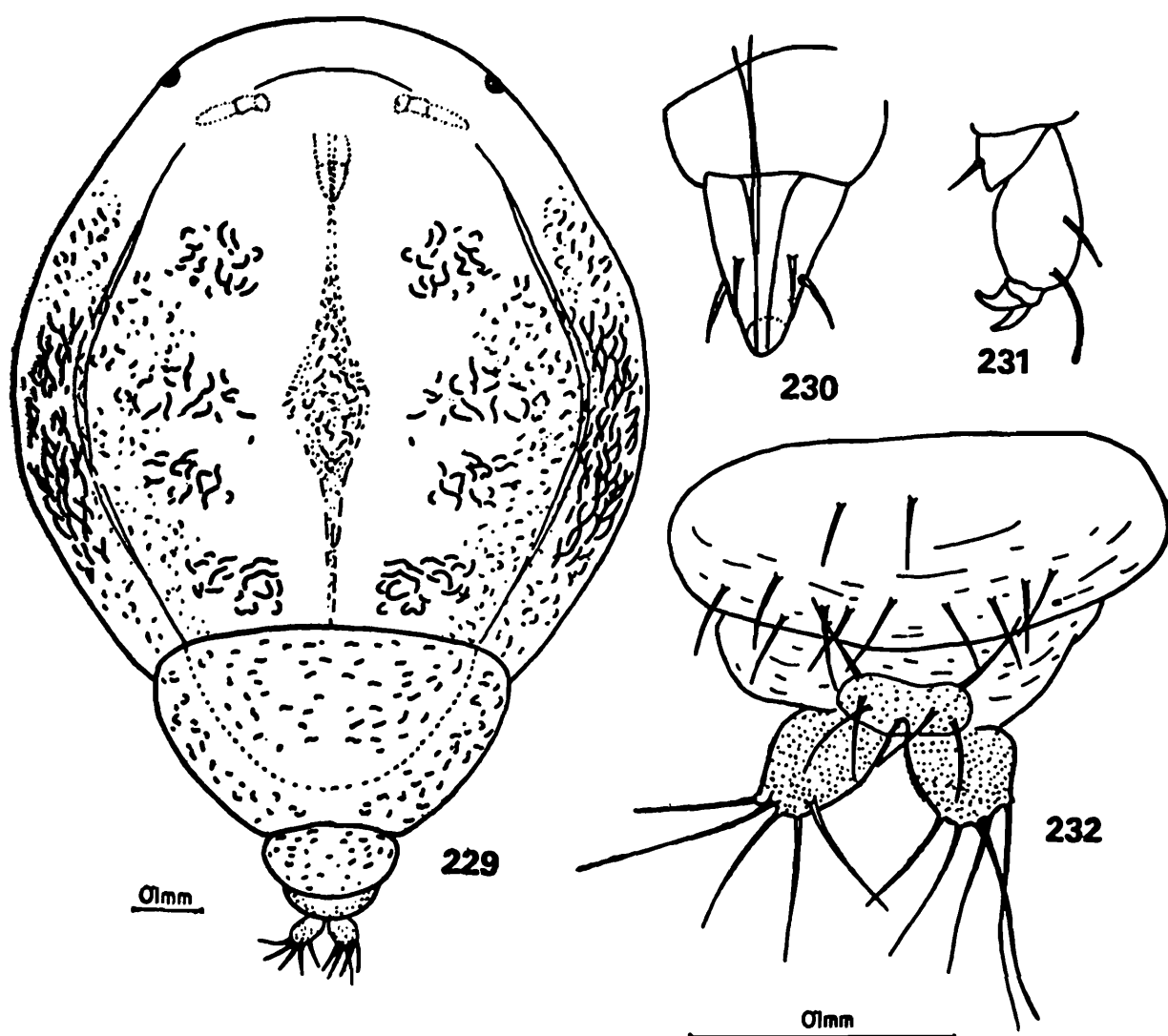
Measurements in mm. :

	Length	Width	Antenna	urs	ht ₂
1.	1.18	0.86	0.12	0.06	0.04
2.	1.60	1.05	0.09	0.06	0.04
3.	1.38	1.13	0.10	0.05	0.036

(1, ex *Quercus incana*, *Phoolchatti*, U.P., 10.8.1981, C.U., Colls. ;
2, 3, ex *Ilex* sp., Kufri, H.P., 31.x.1978, C.U. Colls.).

Other morphs : Not available.

Material examined : 12 apterous aliencolae, from *Ilex* sp., Kufri, Himachal Pradesh, India, 31.x.1978 (Holotype & Paratypes); Four apterous aliencolae from *Quercus* sp., Mashobra, Himachal Pradesh, India, 28.v.1978 (Paratypes ; C.U. Colls.) ; Three apterous alienoalae, from *Quercus incana*, Phoolchatti, Uttar Pradesh, India, 10.10.1981 (Paratypes of *H. querciphaqa*, No. 1268, C.U. Colls.).



Pseudothoracaphis himachali Raychudhuri, Ghosh, Das. Apterous viviparous female : 229, whole body, 230, ultimate rostral segment ; 231, hind tarsus ; 232, caudal region.

Discussion : Raychaudhuri *et al.* (1980) described *Pseudothoracaphis himachali* based on the specimens collected on *Quercus* sp., and *Ilex* sp. during the month of October at Mashobra (c. 2250 m) and Kufri (c 2700 m) in Himachal Pradesh, North West India. Chakrabarti & Raha (in press) described another species *Heminipponaphis querciphae* based on the material collected on *Quercus incana* during the month of October at Phoolchatti (c 2100) Uttar Pradesh, India. As stated earlier, detailed examination of types of *Pseudothoracaphis himachali* Raychaudhuri *et al.* and *Heminipponaphis querciphae* Chakrabarti and Raha clearly indicated that both the material belongs to one species and the name *himachali* is used for the same. The occurrence of the species on *Ilex* appears to be unusual for a Nipponaphidine aphid as no other aphid of this group is so far recorded to use Aquafoliaceae as a host plant group. The species appears to be restricted to high altitude areas of northwestern India (Himachal Pradesh, Uttar Pradesh) and has never been recorded in *Quercus* growing areas of northeastern India. Chakrabarti & Raha (op. cit) mentioned about occurrence of wax pores in nymphs and myrmecophilous nature of the species.

Distribution : India : Himachal Pradesh, Uttar Pradesh.

Types : In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India ; type of *H. querciphae* is deposited in the Biosystematic Research Unit, Department of Zoology, University of Kalyani, India.

Genus 13. *Reticulaphis* Takahashi, 1958

1958. *Reticulaphis* Takahashi, R., *Insecta matsum*, **22** (1-2): 11 ; Ghosh, A. K. and Raychaudhuri, D. N., 1973, *Kontyu*, **41** (4) : 487.
Type species : *Reticulaphis shiiae* Takahashi.

Morphology : Body minute, 0.7-1.0 mm. long, ovate to elliptical, flattened and strongly sclerotised in apterae ; alatae normal. Pro-soma distinctly reticulated. Antennae 2-3-segmented in apterae, 5-segmented in alatae ; last segment, in apterae, rounded at tip, with rudimentary rhinarium ; secondary rhinaria in alatae subannular. Eyes of 2-3 facets in apterae, normal in alatae. Rostrum in alate migrants reaches fore coxae ; ultimate rostral segment

subacute, subequal to second segment of hind tarsus. Abdominal segments 2-7 completely fused and distinctly separated from prosoma. Submarginal hairs on prosoma long, with acute apices or short, flattened with expanded, frayed or acuminate apices; submarginal hairs minute on abdomen; posteromesial hairs on 7th tergite absent; 8th tergite with 2-4 setae of variable lengths. Siphunculi absent. Cauda normal, much broader than long, constricted at base. Legs short, only hind legs little discernible; tarsi rudimentary; dorso-apical hairs, when present, long, fine and capitate; tarsal claws rudimentary or atrophied. Forwings with media very faint, once branched.

Discussion : Takahashi (1958) described the genus with a new species *shiiae* as type species from Japan and indicated that *Thoracaphis fici* Takahashi, var. *foveolatae* Takahashi and *Thoracaphis mirabilis* Takahashi should be included under *Reticulaphis*. Subsequently, Hille Ris Lambers and Takahashi (1959) transferred *Schizoneuraphis distylii* van der Goot to this genus and suggested that *Reticulaphis fici* (Takahashi) and *fici foveolatae* (Takahashi) should be treated as two subspecies of *distylii*; four more subspecies, all on *Ficus*, were described by Hille Ris Lambers and Takahashi (op. cit) and all these 6 closely related subspecies may be separated by the nature of marginal setae on the dorsum (Ghosh, A. K. and Raychaudhuri, 1973). As such the genus is composed of three distinct species viz. *distylii* (van der Goot) and its six subspecies *mirabilis* (Takahashi) and *shiiae* Takahashi. In the region only one subspecies of *distylii*, viz. *distylii rotifera* is known from North West India. Ghosh, A. K. (1981) considered *Reticulaphis* as closely related to *Dermaphis* Takahashi on one side and *Quernaphis* Takahashi on the other, differing mainly in the nature of tergum.

Biology : *Reticulaphis distylii* (van der Goot) is the only species which still retains a heteroecious life cycle, alternating between *Distylium stellarae* and *Ficus* spp.; all other species and subspecies are known from secondary hosts, which include a number of species of *Ficus*, and for *shiiae* Takahashi, *Castanopsis cuspidata* while the host record for *distylii rotifera* in India indicates *Quercus*. Hille Ris Lambers and Takahashi (1959) described in details fundatrix, apterous viviparous, alatae fundatrigeniae and embryones

of *distylii* from elevated finger-tip like leaf galls of *Distylium* and apterae, alatae and larvae of *rotifera* on *Ficus* in Java. At least one subspecies of *distylii* viz. *rotifera* produce wax filaments or rods and is attended by aggressive black ants.

Distribution : India ; Formosa ; Japan ; Java.

Type-species : *Reticulaphis shiiae* Takahashi, 1958 ; deposited in the collections of Entomological Laboratory, Hokkaido University, Sapporo, Japan.

Key to the species of *Reticulaphis* Takahashi

Marginal hairs on posterior part of prosoma somewhat curved and usually with obtuse, enlarged or frayed apices.....*D. distylii rotifera*
H.R.L. and Takahashi
Marginal hairs flagellate, long and acute.....*R. shiiae* Takahashi

34. *Reticulaphis distylii rotifera* Hille Ris Lambers & Takahashi (Figs. 233-234)

1959. *Reticulaphis distylii rotifera* Hille Ris Lambers, D., Takahashi, R., *Tijdschr Ent.*, **102** (1) : 12.
1973. *Reticulaphis distylii rotifera*, Ghosh, A.K., Raychaudhuri, D. N., *Kontyu*, **41** (4) : 489.
1976. *Reticulaphis distylii rotifera*, Eastop, V.F., and Hille Ris Lambers, D., *Survey of World's Aphids*, 373.
1980. *Reticulaphis distylii rotifera*, Raychaudhuri, D.N., Ghosh, L. K. and Das, S. K., *Ins. matsum*, **20** : 38.

Apterous viviparous female : Body 0.50-0.85 mm long with 0.45-0.52 mm as maximum width, dark sclerotic, with distinct dorsal reticulations. Antennae unsegmented, very small ; rhinaria minute, placed near apex. Eyes of 3 facets. Rostrum very short, ultimate rostral segment narrow, without any hair. Prosoma large, separated from fused abdominal segments (2-7) by a membranous suture ; spinal hairs on prosoma thick, 0.012-0.019 mm long, with oblique apices, arranged in 5 pairs, one pair on head between the eyes, 3 pairs on pro-meso- and meta-notal area and one pair on abdominal segment 1 ; pleural hairs absent ; marginal hairs (30-34) duplicated on thoracic region, 0.04-0.06 mm long, little

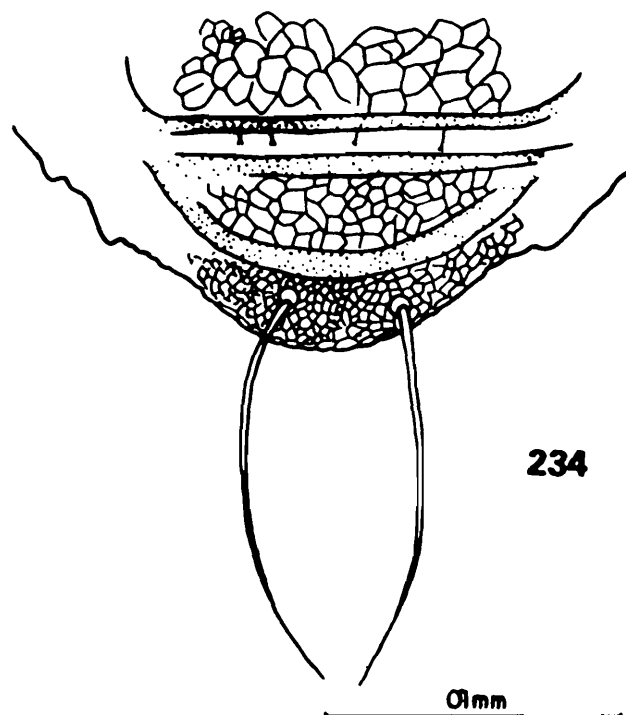
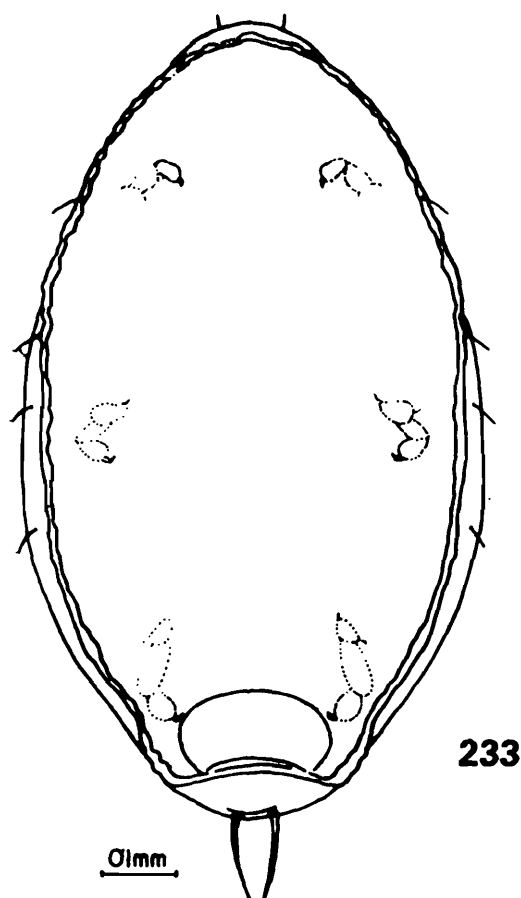
curved upward and expanded at apices, appearing fan-shaped. Abdominal segments (2-7) fused, much reduced, reticulated over dorsum and bear 6 pairs of submarginal hairs which are minute and discernible as pores ; 8th tergite 2 thin, acute hairs, similar to marginal hairs. Siphunculi absent. Cauda knobbed. Subanal plate bilobed. Legs much reduced in size, appear bent and flat under the body, and without any tarsal claws ; only knee-joint of hind legs visible from above.

Colour : Dark purplish black in life.

Measurements in mm. :

	Length	Width	Antenna	hind tibia
1.	0.84	0.52	0.06	0.05
2.	0.96	0.45	0.05	0.05

(1, 2, ex *Quercus* sp., Mashobra, H.P., 28.x.78, C.U.Colls.).



Reticulaphis distyli rotifera Hille Ris Lambers & Takahashi Apterous viviparous female : 233, whole body ; 234, posterior portion of abdomen.

Other morphs : Hille Ris Lambers and Takahashi (1959) have provided detailed description of (i) alate viviparous female (ii) larvae of alate adults which include descriptions of first instar, second instar, third instar (alate and apterous) and fourth instar (alate) (iii) embryos from inside the alate on *Ficus*. None of these morphs have been collected from India, so far ; the description of alate is based on Hille Ris Lambers and Takahashi (op. cit).

Alate viviparous female : Body 1.6-1.7 mm long. Head and thorax sclerotic ; dorsal cephalic hair 10-12, of which 1-2 of the hairs (out of 4-6) on posterior part of vertex much shorter than others. Antennae 5-segmented ; segment III with 19-23, IV with 4-8, V with 4-5 rhinaria ; Rostrum very short ; ultimate rostral segment narrow, with 3 pair of subapical hairs. Abdominal segments 1st-4th and 7th, each with one pair of long marginal hairs besides 4-6 spinal hairs on 1st tergite and 0-1 spinal hair on others ; 5th and 6th tergites appear to be fused, bearing 2 pair of long marginal hair and 1-3 spinal hairs ; 8th tergite with 2 long dorso-median hairs besides 2-3 shorter hairs ; longer hairs ± 0.105 mm long, shorter ones 0.070 mm long, the former often with an abrupt swelling before their acute apices. Siphunculi not discernible, at most marked by a faint annular structure. Cauda knobbed. Subanal plate bilobed.

Measurements in mm. (other than for antennal segments) :

Length	Antenna	Antennal segments (proportion)		
		III	IV	V
1.6	0.62	100	38	23

Material examined : Four apterous aliencolae from *Quercus* sp., Mashobra, Himachal Pradesh, India, 28.x.1978 (C.U. Colls).

Discussion : Hille Ris Lambers and Takahashi (1959) mentioned that life cycle of the nominate species *Reticulaphis distylii* (van der Goot, 1917), has not been described. It is known to produce galls on *Distylium stellare* its primary host, and appears to migrate to *Ficus* spp. from which it was recorded earlier as *Astegopteryx fici* Takahashi (1927). They described in details material from *Distylium stellarae* collected in Java which includes Fundatrix,

Apterous viviparous female of 2nd generation in the galls, alate viviparous female or fundatrigeniae of 3rd generation and embryos from preceeding morphs. While dealing with the material from *Ficus* spp., several forms each with constant shape of marginal hairs, were recognised as subspecies. One of the subspecies recognised, *rotifera*, was described from a collection from undersurface of leaves of *Ficus pruniformis* ; this subspecies is separable from others in having somewhat regular body margin, only knee of hind legs visible from above, marginal hairs somewhat enlarged near tip and those on the posterior part of prosome being curved. The specimens from India, were collected on *Quercus* in north-western Himalayan region, and so far forms the only record from the area.

Distribution : India : Himachal Pradesh; Java ; Taiwan.

Types : In the collections of D Hille Ris Lambers, Bennekom, The Netherlands, and Entomological Institute, Faculty of Agriculture, Hokkaido University, Sapporo, Japan.

35. *Reticulaphis shiiae* Takahashi

1958. *Reticulaphis shiiae* Takahashi, R., *Insecta matsum.*, 22 : 11.

Apterous viviparous female : Body oval dark brown, sclerotized, flattened 0.78-0.84 mm long. Antennae minute, 2-segmented, little longer than hind tibiae. Prosome defined from fused abdominal segments 2-7 pair of setae in the front margin hardly discernible. Dorsum with distinct reticulation, marginal setae long and uneven ; submarginal setae hardly discernible and postero mesial setae on 7th absent. Siphunculi absent. 8th tergite with at least 2 setae. Legs with atrophied tarsi, claws rudimentary.

Colour : Not known, apparently dark.

Measurements in mm. :

	Length	Width	Antenna	hind tibia
1.	0.78	0.56	0.05	0.05
2.	0.84	0.62	0.05	0.05

(1, 2 ex Indet Host, IARI, New Delhi, 4.v.1961, CIE Colls.).

Material examined : Four apterous viviparous females, from undetermined host, New Delhi, India, 4.v.1961, leg. *Indian Agric. Res. Inst.*, C.I.E. 19443 : 5, from collections of British Museum, Nat. Hist. (London) no. 253/64.

Discussion : The single slide with 4 remounted apterae appeared partly damaged and most of the marginal setae were missing. The type material was examined earlier and the present specimens appear to be close to *shiiae* Tak. The only other *Reticulaphis* species with long setae, is *R. distylii fici* (Takahashi) in which the marginal setae are never flagellate.

Distribution : India ; Japan.

Types : In the collections of Entomological Institute, Faculty of Agriculture, Hokkaido University, Sapporo, Japan.

Genus 14. *Sinonipponaphis* Tao, 1966

1966. *Sinonipponaphis* Tao, C.C.C., *Q. J. Taiwan Mus.*, 19: 175. Ghosh, A. K. and Raychaudhuri, D. N., 1973. *Kontyu* 41 (A) 490. Eastop, V. F., and Hille Ris Lambers, D. The Survey of Worlds Aphids, 390. Type species ; *Astegopteryx formosana* Takahashi.

Morphology : Body convex. Prosoma consolidated at least partly with fused abdominal segments. Tergum smooth but bearing pointed triangular spine-like pustules. Antennae 4-segmented. Eyes of 3 facets. Ultimate restral segment distinctly longer than second segment of hind tarsus. Dorsal hairs on prosoma fine, distinct. Abdominal dorsum (2-7) with 6 pairs of long submarginal hairs, and a pair of posteromesial hairs on 7th tergite ; 8th tergite with 2-8 long hairs. Siphunculi small or conspicuous. All legs with 2-segmented tarsi and normal claws. Alatae with 5-segmented antennae, segment III nearly as long as IV+V taken together ; ultimate rostral segment shorter than in apterae. Dorsal hairs thick and long. Wing veins infuscated, forewings with media once branched, hind wings with both oblique.

Discussion : Tao described the new genus with *formosana* (Takahashi) as type species, on the basis of short triangular spine like pastules on dorsum. Eastop and Hille Ris Lambers (1976)

correctly enlisted *Nipponaphis monzeni* Takahashi under this species, on the basis of similar characters in apterae. Ghosh and Raychoudhuri (1973), while describing *Nipponaphis holboelliae* from eastern India, remarked about its resemblance with *monzeni* (Tao). The former species is treated here for the first time under *Sinonipponaphis* Tao, and as such the genus is now composed of three species ; of the three species, *formosana* is only known from China, *monzeni* from Japan and India and *holboelliae*, only from India. The relationship of the genus with *Nipponaphis* and allied genera is obvious and it appears to be at an advanced stage of evolution (as *Nipponaphis*) within the tribe because of presence of normal body, antennae, legs, siphunculi and cauda, in the members of the genus.

Biology : Of the three species, *formosana* is known only from *Machilus* (Lauraceae) : *monzeni* is known to alternate between *Distylium recemosum* where it forms galls and *Quercus glauca* in Japan but the Indian record is only from *Machilus* sp. ; *holboelliae* is the only species in the entire tribe which has *Holboellia latifolia* (Berberidaceae) as host. The host range as such include plant species of Fagaceae and Lauraceae (besides Berberidaceae) ; Some members of the genus are capable of leading heteroecious holocyclic life cycle between *Distylium* and *Quercus* (as *monzeni* in Japan) and in this aspect also *Sinonipponaphis* closely resembles *Nipponaphis*, in having a Fagaceae—Hamamelidaceae—Lauraceae host complex. Details of biology of *monzeni* in Japan has been provided by Sorin (1958).

Distribution : India ; China ; Japan.

Type species : *Astegopteryx formosana* Takahashi 1927 ; deposited in Agricultural Research Station, Taipei, Taiwan.

Key to the species of *Sinonipponaphis* Tao

Apterous viviparous female :

Body large 1.70—2.09 mm long. Dorsal hairs on prosoma 0.05—0.06 mm long, on abdomen 0.060—0.066 mm long. 8th tergite with 8 fine hairs upto 0.073 mm long. On *Holboellia latifolia*.....*S. holboelliae*
(Ghosh and Raychaudhuri)

Body small, 1.2—1.5 mm long. Dorsal hairs on 10.100-0.98 mm long, on abdomen upto 0.100 mm long. 8th tergite with 2 hairs upto 0.083 mm long.

On *Machilus* sp.....*S. monzoeni* (Takahashi)

36. *Sinonipponaphis holboelliae* (Ghosh & Raychoudhuri) (Figs. 235-239)

1971. *Nipponaphis* sp. Ghosh, A.K., Ghosh, M.R. and Raychoudhuri, D.N., *Orient. Insects*, **5** (3) : 330.
 1973. *Nipponaphis holboelliae* Ghosh, A.K., and Raychoudhuri, D.N., *Kontyu*, **41** (4) : 480.
 1976. *Nipponaphis holboelliae*, Eastop, V. F. and Hille Ris Lambers, D. Survey of the Worlds Aphids, 322.
 1980. *Nipponaphis holboelliae*, Raychoudhuri, D.N., Ghosh, M. R., Ghosh, Pal, P.K., and Ghosh, A.K., *In Aphids of North-East India and Bhutan*, 386.

Apterous viviparous female : Body elongate, semioval, 1.7-2.09 mm long with 1.04-1.40 mm as maximum width, pale on anterior half, distinctly darker on abdomen. Antennae 4-segmented $0.19-0.21 \times$ as long as the body ; segment I with 1 and II with 2 hairs, 0.026-0.036 mm long ; basal three segments nearly smooth, segment IV somewhat wrinkled. Ultimate rostral segment stout, $1.5 \times$ as long as second segment of hind tarsus and bearing 2 pairs of long preapical hairs. Prosoma consolidated with fused abdominal segments (2-7), the latter being demarcated only laterally : dorsum of prosoma densely covered with numerous conical spine-like pustules which are pointed or rounded at apices and often appear as bent ; marginal pustules similar to those on dorsum ; hairs on the dorsum of prosoma fine, up to 0.05-0.06 mm long, $1.5 \times$ as long as the basal diameter of antennal segment III and $0.20 \times$ as long as the antenna ; submedian hairs never duplicated. Dorsum of fused abdominal segments (2-7) with less distinct pustules, and these becoming fewer and irregular caudad ; abdominal dorsum with 6 pair of fine submarginal hairs (0.060-0.066 mm) and a pair of posteromesial hairs (0.066 mm) on 7th tergite, these being up to $2.5 \times$ as long as the basal diameter of antennal segment III ; 8th tergite sclerotic without any pustules but with wrinkles and bearing 8 fine hairs up to 0.073 mm long. Siphunculi con-

spicuous, placed on dark sclerotic bases. Cauda dark brown to dusky, constricted at base, nearly twice as long as broad and with 9-10 long fine hairs. Anal plate bilobed, each lobe with 6-7 long hairs. Legs pale, tibiae nearly smooth, bearing fine hairs, longest one on hind tibiae hardly exceeding $0.50\times$ as long as the width at the middle of the tibiae ; tarsi 2-segmented ; first tarsal segments with 3, 3, 3 hairs.

Colour : Brownish in life.

Measurements in mm. :

	Length	Width	Antenna
1.	1.93	1.3	0.41
2.	2.09	1.4	0.40
3.	1.70	1.11	0.32

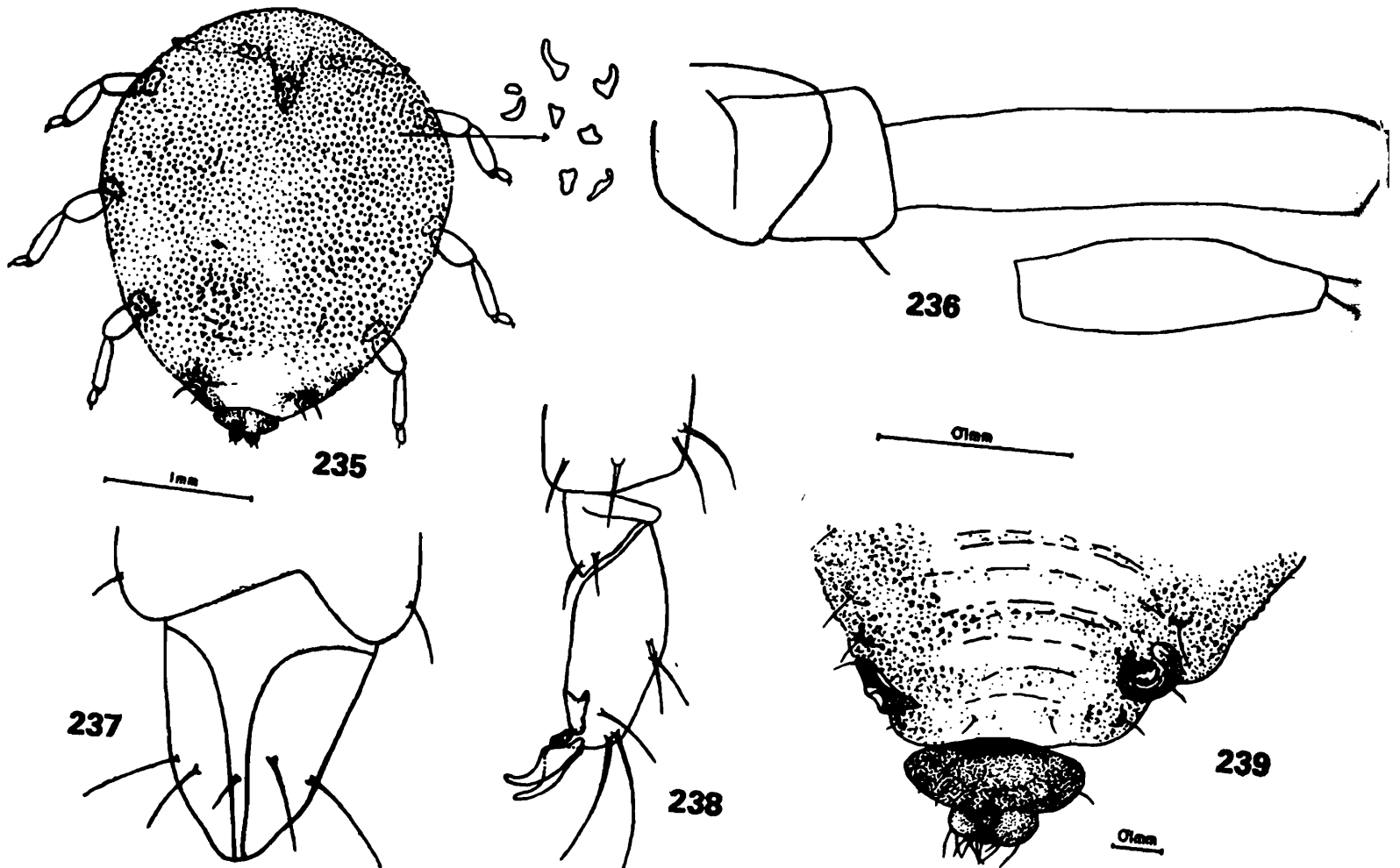
Antennal segments				urs	ht ₂
I	II	III	IV		
0.05	0.05	0.20	0.11	0.10	0.08
0.04	0.05	0.20	0.11	0.11	0.08
0.03	0.03	0.15	0.08	0.10	0.07

(1, 2, 3 ex *Holboellia latifolia*, Darjeeling, 28.1.1969, C.U. Colls.).

Other Morphs : Not known.

Material examined : 8 apterous viviparous female from *Holboellia latifolia* Darjeeling, West Bengal, India, 28.1.1969, Coll. S D. Chakrabarti (Types : C.U. Colls.).

Discussion : Ghosh and Raychaudhuri (1973) while describing the species under *Nipponaphis* correctly pointed out its affinity with *Sinonipponaphis monzeni* (Takahashi) in the shape of triangular dorsal spine instead of usual pustules. In both the species, dorsal hairs are shorter than length of antennae but *holboellae*



Sinonipponaphis holbeolliae A. K. Ghosh & Raychaudhuri. Apterous viviparous female : 235, whole body ; 236, antenna ; 237, ultimate rostral segment ; 238, hind tarsus ; 239, posterior portion of abdomen.

differs from *monzeni* in having larger body, 8 hairs on 8th tergite and different host association (Berberidaceae). The species is now treated under *Sinonipponaphis* because of its dorsal spines and nature of dorsal hairs. The species form dense colonies and remain covered with mealy secretion.

Distribution : India : West Bengal.

Types : In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India.

37. *Sinonipponaphis monzeni* (Takahashi)
(Figs. 240-249)

1958. *Nipponaphis monzeni* Takashi, R. *Akitu*, 7 : 88.
1958. *Nipponaphis monzeni*, Sorin, Masato, *Akitu*, 7 : 89.
1973. *Nipponaphis monzeni*, Ghosh, A. K. and Raychadhuri, D. N., *Kontyu*, 41 (4) : 480.

Apterous viviparous female : Body pale yellow 1.2-1.3 mm long with 1.04-1.2 mm as maximum width. Antennae thin, 4-segmented, 0.20 × as long as the body ; segment I and II subequal, each bearing a fine hair up to 0.033 mm long and 1.6 × as long as the basal diameter of antennal segment III ; segment III long, thin, nearly smooth, segment IV narrowed on processus terminalis. Eyes of 3 facets. Rostrum reaches 0.33 portion of prosoma, ultimate rostral segment 1.4 × as long as second segment of hind tarsus. Tergum smooth, covered with pointed triangular spines, which are broadened at bases ; hairs on the dorsum of prosoma fine, appear duplicated in spinal, pleural and submarginal areas, 0.100-0.198 mm long, longest one always on submarginal areas. Abdominal segments (2-7) fused, separated from prosoma, bearing 6 pair of long submarginal hairs (up to 0.100 mm long) and a pair of posteromesial hairs on 7th tergite ; 8th tergite dark sclerotic, bearing a pair of long hairs up to 0.083 mm long. Siphunculi small. Cauda dark brown, constricted at base. Subanal plate bilobed. Legs pale, exposed ; hairs on tibiae fine, those on hind tibiae up to 0.060 mm long, nearly 2.0× as long as the diameter at the middle of hind tibia ; but a number of short hairs also occur measuring 0.013-0.023 mm : tarsi 2-segmented, dorso-apical hairs long ; claws normal.

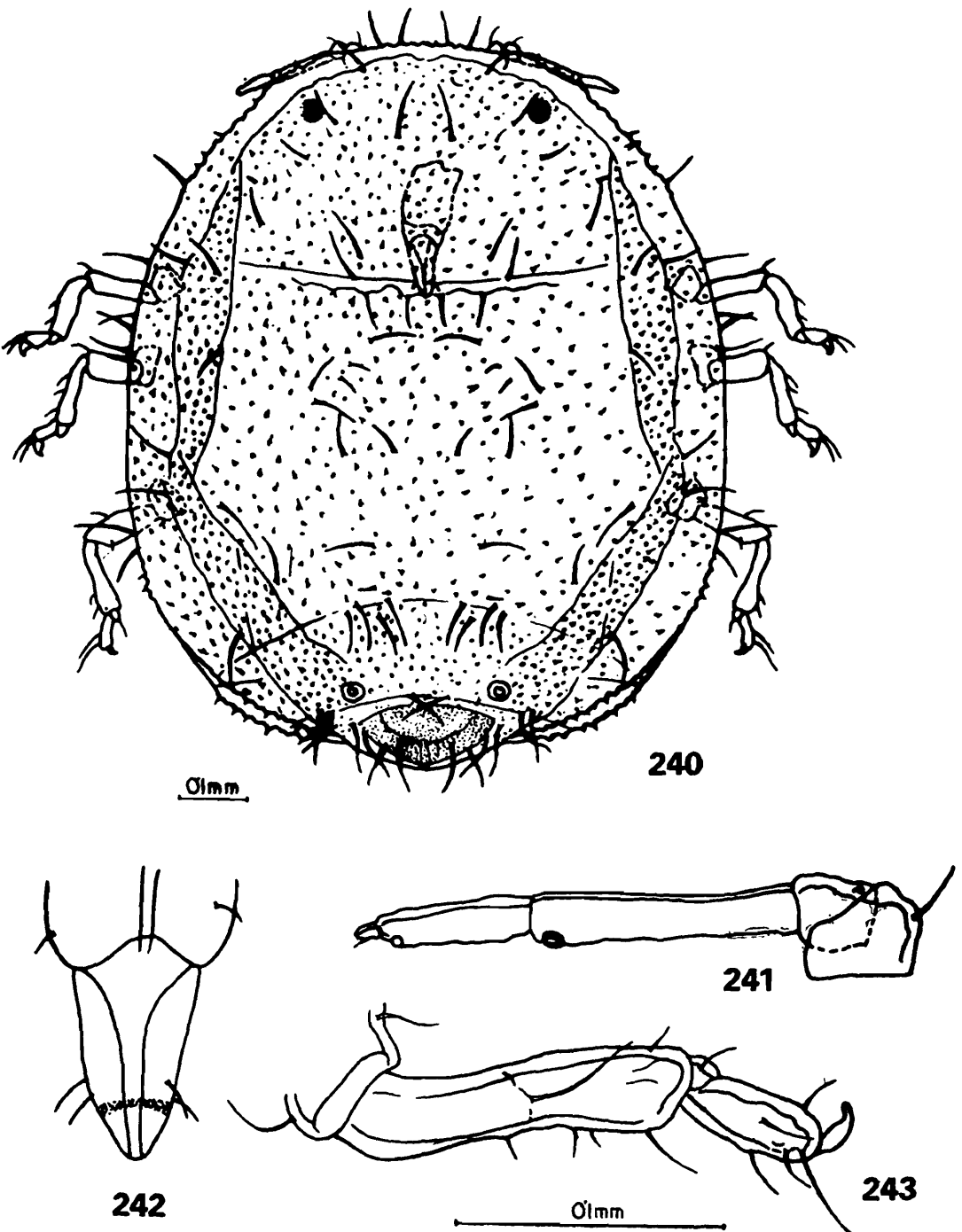
Colour : Dark brown in life.

Measurements in mm. :

	Length	Width	Antenna
1.	1.19	1.04	0.23
2.	1.32	1.20	0.24

Antennal segments				urs	ht ₂
I	II	III	IV		
0.02	0.03	0.11	0.07	0.086	0.060
0.02	0.08	0.12	0.07	0.088	0.062

(1, 2, ex *Machilus* sp., Shillong, Meghalaya, 4.iii.1981, C.U. Colls.).



Sinonipponaphis monzeni (Takahashi) Apterous viviparous female : 240, whole body ; 241, antenna ; 242, ultimate rostral segment ; 243, part of hind leg.

Alate viviparous female : Body elongate brown to dark brown on head and thorax, pale on abdomen, 1.68-1.84 mm long 0.75-0.82 mm as maximum width. Dorsal cephalic hairs 0.033-0.040 mm long, up to twice as long as the basal diameter of antennal segment III. Antennae 5-segmented, dark brown, 0.41 × as long as the body ; hairs on antennae fine, 8-3 on each of segment I and II, hardly discernible on other segments, up to 0.020-0.023 mm long and equal to the basal diameter of antennal segment III ; segment III with 24-32, IV with 11-15, V with 7-10 annular secondary rhinaria distributed over their entire lengths ; processus terminalis very short. Eyes with large ocular tubercles. Rostrum reaches near midcoxae, ultimate rostral segment nearly equal to second segment of hind tarsus. Abdominal dorsum pale, hairs on the dorsum of abdomen thick, with acute apices, arising from tubercles, specially on marginal region of 3rd-6th segments ; marginal hairs duplicated on 1st and 2nd tergites, single on others, 0.050-0.083 mm long ; spinal hairs of similar nature and length, both marginal and spinal hairs longer on posterior tergites ; 8th tergite with 2 spinal hairs, 2 pleural hairs and 2 marginal hairs. Siphunculi with small pores, located on wrinkled elevated cones. Cauda dark sclerotic bearing 6-7 fine hairs. Subanal plate bilobed, each lobe with 5-6 fine hairs. Legs pale, femora and tibiae with rough spinulose imbrications; hairs on legs stiff, acute, 0.023-0.050 mm long, longest one on hind tibiae equal to the width at the middle of hind tibiae ; first tarsal segments with 3, 3, 3 hairs of which middle one is longest (0.050 mm). Wings with veins dark, thick, forewings with media once branched, anal faintly bordered brown ; hind wings with both obliques.

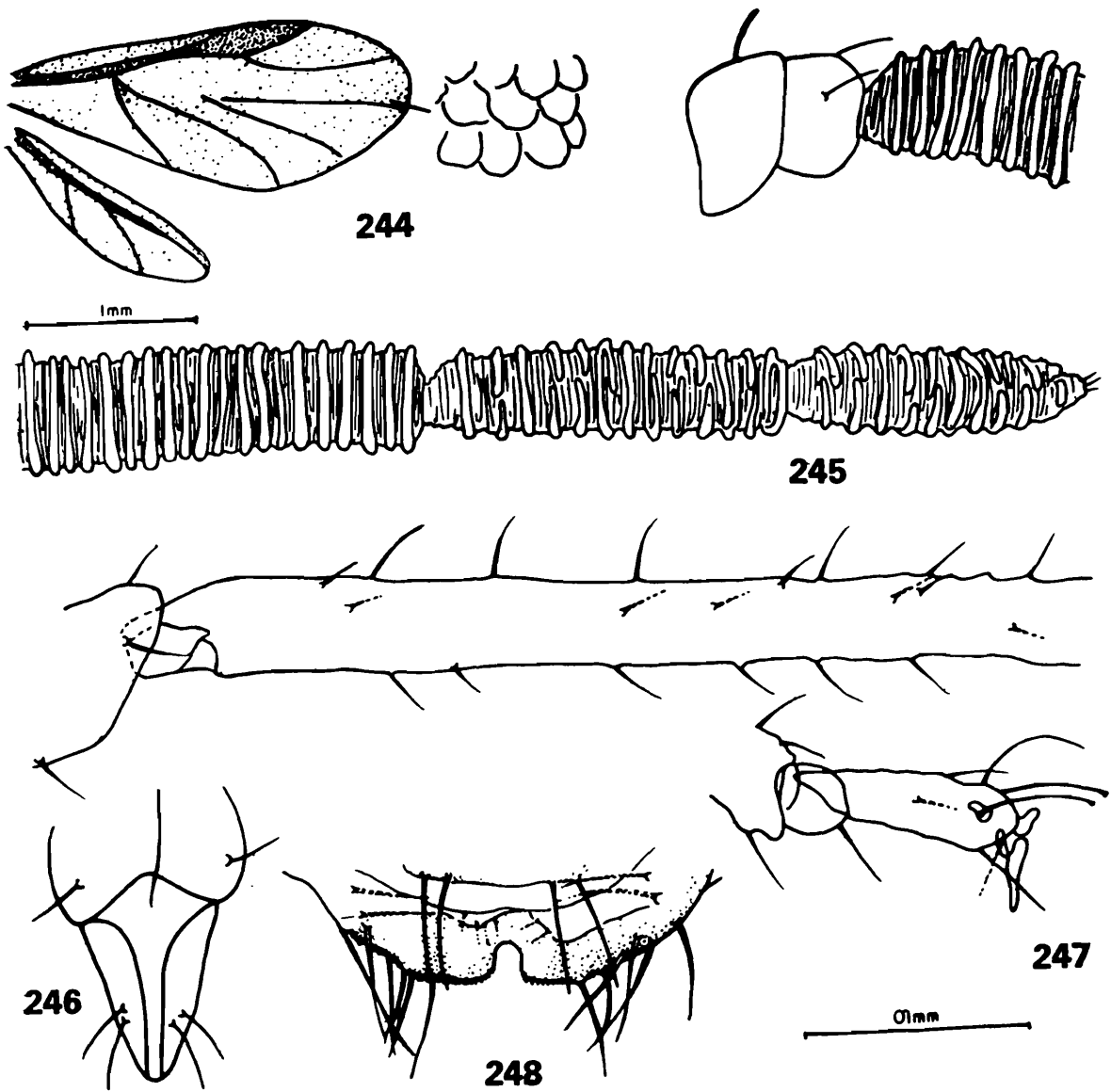
Colour : Not recorded.

Measurements in mm. :

	Length	Width	Antenna
1.	1.84	0.75	0.71
2.	1.68	0.82	0.69

Antennal segments			urs	ht ₂
III	IV	V		
0.29	0.18	0.16	0.10	0.11
0.29	0.16	0.13	0.10	0.11

(1, 2, ex *Machilus* sp., Shillong, Meghalaya, 4.iii. 1981, C.U. Colls.).



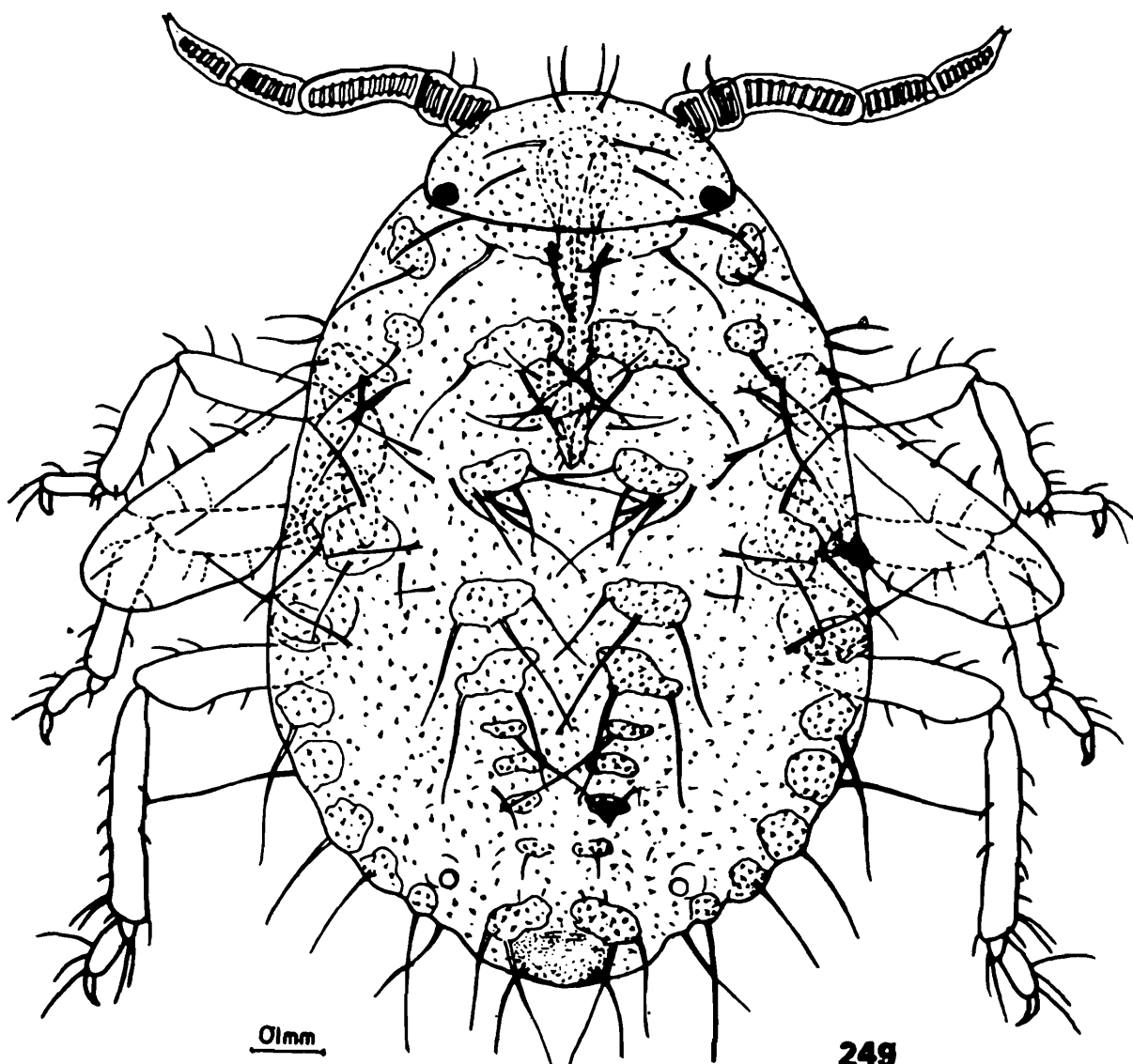
Alate viviparous female : 244, wings ; 245 antenna ; 246, ultimate rostral segment ; 247, hind leg ; 248, caudal region.

Nymph (Alate, late stage) : Body elongate, 1.58-1.65 mm long with 0.82-.96 mm as maximum width. Head brown, covered with small rounded denticles ; dorsal cephalic hairs thick, acute at apices, 14-16 in number and up to 0.198 mm long. Antennae thick, brown, 5-segmented, 0.33-0.35× as long as the body, segment I and II each with a single hair up to 0.060-0.066 mm long ; flagellum without any hair. Rostrum reaches mid coxae, ultimate rostral segment nearly equal to the second segment of hind tarsus. Thoracic tergum denticulate, bearing segmented paired, marginal and spinal tubercles which bear long, thick hairs with acute apices (0.163-0.230 mm) besides some shorter hairs (0.050-0.083 mm). Abdominal dorsum pale bearing large denticulate, sclerotic, marginal tubercles on 1st-7th segments and similar spinal tubercles on 1st-4th and on 7th segment ; 5th and 6th tergites with small flat spinal scleroites in place of tubercles, these becoming smaller caudad ; each marginal tubercle bears a single, long, thick acute hair (0.198-0.230 mm) on 3rd-7th tergites and 2-4 similar hairs on 1st-2nd segments ; spinal tubercles bear similar single hair on 3rd, 4th and 7th and duplicated hairs on 1st and 2nd tergites ; spinal hairs absent on 5th and 6th tergites ; 8th tergite dark sclerotic bearing 6 hairs. Siphunculi present. Legs normal, brown bearing fine hairs.

Measurements in mm. :

	Length	Width	Antenna		
1.	1.58	0.82	0.55		
2.	1.65	0.96	0.55		
	Antennal segments			urs	ht ₂
III	IV	V			
0.18	0.12	0.12	0.10		0.11
0.15	0.13	0.13	0.10		0.11

(1, 2, ex *Machilus* sp., Shillong, Meghalaya, 4.iii. 1981, C.U. Colls.).



Alate nymph : 249, wholebody.

Other morphs : Not available.

Material examined : Two apterous aliencolae, two alate viviparous females and two alate nymphs from *Machilus* sp., Shillong, Meghalaya, India, 4.iii.1981, (C.U. Colls.).

Discussion : Takahashi (1958), while dealing in a short two page note on 8 species of aphids causing galls on *Distylium racemosum* in Japan, mentioned about a new species, *Nipponaphis monzeni* briefly on page 87 and again the key to the species on page 88. The note (written in Japanese) indicates its distinctiveness from *Quadrartas yoshinomiya* Monzen, *N. yanonis* Matsumura, *N. atamnalis* Monzen, *N. globuli* Nonzen and showed its affinity on

one side with *N. distychii* Pergande and on the other hand with *N. gigantea* Takahashi and *N. distylilicola* Monzen. No detailed description and illustration for the new species was provided by Takahashi (op. cit).

However, Sorin (1958) described the life-cycle of morphs of *Sinonipponaphis monzeni* (under *Nipponaphis monzeni*) and illustrated the aptera and the galls produced on *Distylium racemosum* in Japan. According to Sorin (op. cit) the species alternates between *Quercus glauca* and *Distylium racemosum* and completes holocyclic, heteroecious life cycle, as does *Nipponaphis distychii* Pergande.

Eastop and Hille Ris Lambers (1976) transferred *monzeni* to *Sinonipponaphis* Tao 1966, as the second species besides the type, *formosana* (Takahashi) and the same status has been followed here. It may be noted that unlike *monzeni* in Japan, the specimens in northeastern India use *Machilus* as secondary host, as in the case of *S. formosana* (Tak).

Distribution : India : Meghalaya ; Japan.

Types : In the collections of Entomological Institute, Faculty of Agriculture, Hokkaido University, Sapporo, Japan.

Genus 14. *Thoracaphis* van der Goot 1917

1917. *Thoracaphis* van der Goot, P. *Contrib. Faune Indes Mesrl.*, **242** ; Ghosh A. K. and Raychadhuri, D. N., 1973. *Kontyu*, **41** (4) : 491 ; Raychadhuri, D. N., Ghosh, M. R., Pal, P. K., Ghosh, A. K., 1980. *In Aphids of North East India and Bhutan*, 392.

Type species : *Thoracaphis arboris* van der Goot.

Morphology : Body depressed, aleuroidiform in apterae, normal in alatae. Head, thoracic segments and abdominal segment 1 fused (prosoma) and incompletely or completely separated from abdominal segments 2-7. Dorsum in apterae bearing papillae, pustules or reticulation and gland-like intersegmental "muskel-platten" Antennae 3-segmented in apterae, 5-segmented in alatae ; primary rhinaria, normal, round and small in apterae, large,

elongate and ciliated in alatae ; secondary rhinaria in alatae, subannular, present on all flagellar segments. Eyes in apterae of 3 facets, normal in alatae. Rostrum short, ultimate rostral segment equal to second segment of hind tarsus and without accessory hairs. Abdominal segments 2-7 in apterae either completely fused or indicate variable segmentation. Marginal hairs usually long and fine, sometimes capitate or narrowed at distal part (e.g. *flavus*) ; 7th segment without posteromesial hairs ; dorsal hairs may be similar to marginal hairs or much shorter and thinner (e.g. *rappardi*) ; 8th tergite always distinctly defined and bears 2-4 hairs. Siphunculi small, poriform, sometimes with a hair placed anteriorly to each siphunculus (e.g. *rappardi*). Cauda broader than long, constricted at base and bearing many fine hairs. Subanal plate bilobed. Subgenital plate with 16-25 hairs. Legs short, normal, tarsi 2-segmented ; first tarsal segment with 3, 3, 2 hairs ; dorso-apical hairs on second tarsal segment slightly expanded. Media or forewings once branched ; cubitus and anal united at base ; hind wings with both obliques.

In larvae, head fused with pronotum, mesonotum and metanotum free ; abdominal tergites 1-7 completely fused ; antennae of 4 segments ; siphunculi spot-like ; legs with 2-segmented tarsi and normal claws.

Discussion : The genus was erected with only one species *arboris* van der Goot from Java. Earlier authors often confused members of other genera with *Thoracaphis*. A total of about 34 species of aphids have been described under *Thoracaphis*, of which only *arboris* van der Goot 1917 (Java), *crematogastri* Takahashi 1941 (Thailand), *flava* Takahashi 1950 (Malayasia), *jici* Swezey 1921 (? China), *linderiae* Shinji 1926 (Japan) and *rappardi* Hille Ris Lambers and Takahashi 1959 (Java) have been retained by Eastop and Hille Ris Lambers (1976) under this genus. Ghosh and Raychaudhuri (1973) have discussed the status of many species specially from Japan and described a species from India without assigning any name ; the same is described here as *Thoracaphis quercicola* n. sp. This genus, like many other genera of Hormaphidinae, appears to be restricted to South-East and Eastern Asia.

Biology : *T. arboris* has been recorded from a *Quercus*-like host plant on Java. *T. crematogastri* is only known from apterae collected on *Quercus* in Thailand and is reported to be protected by ants of the genus *Crematogaster*. *T. flavus* is also known only by apterae from *Quercus* in Malayasia and appears very distinctive by its small size (0.5 mm) and possession of capitate hairs. *T. linderæ* has been redescribed by Takahashi (1958) from Japan where three plants viz. *Lindera* (= *Benzion*) *umbellatum*, *Parabenzion praecox* and *P. trilobum* are reported to be infested in May and June. Apterous adults and alate nymphs of *T. rappardi* have been recorded in December in Java, both being collected on *Viscum articulatum*, a hyperparasite on *Scurrula* which grows in turn on *Ceiba* sp. and shows myrmecophily. *T. quercicola* is known both by apterous and alate adults collected largely on *Quercus dealbata* during August-September and also in March. As such, plants of Fagaceae, Lauraceae and Loranthaceae appear to serve as definite hosts for members of this genus (except one record of *quercicola* from *Pieris ovalifolia* which is a plant of Ericaceae). No host alternation has been definitely known for any of the existing species.

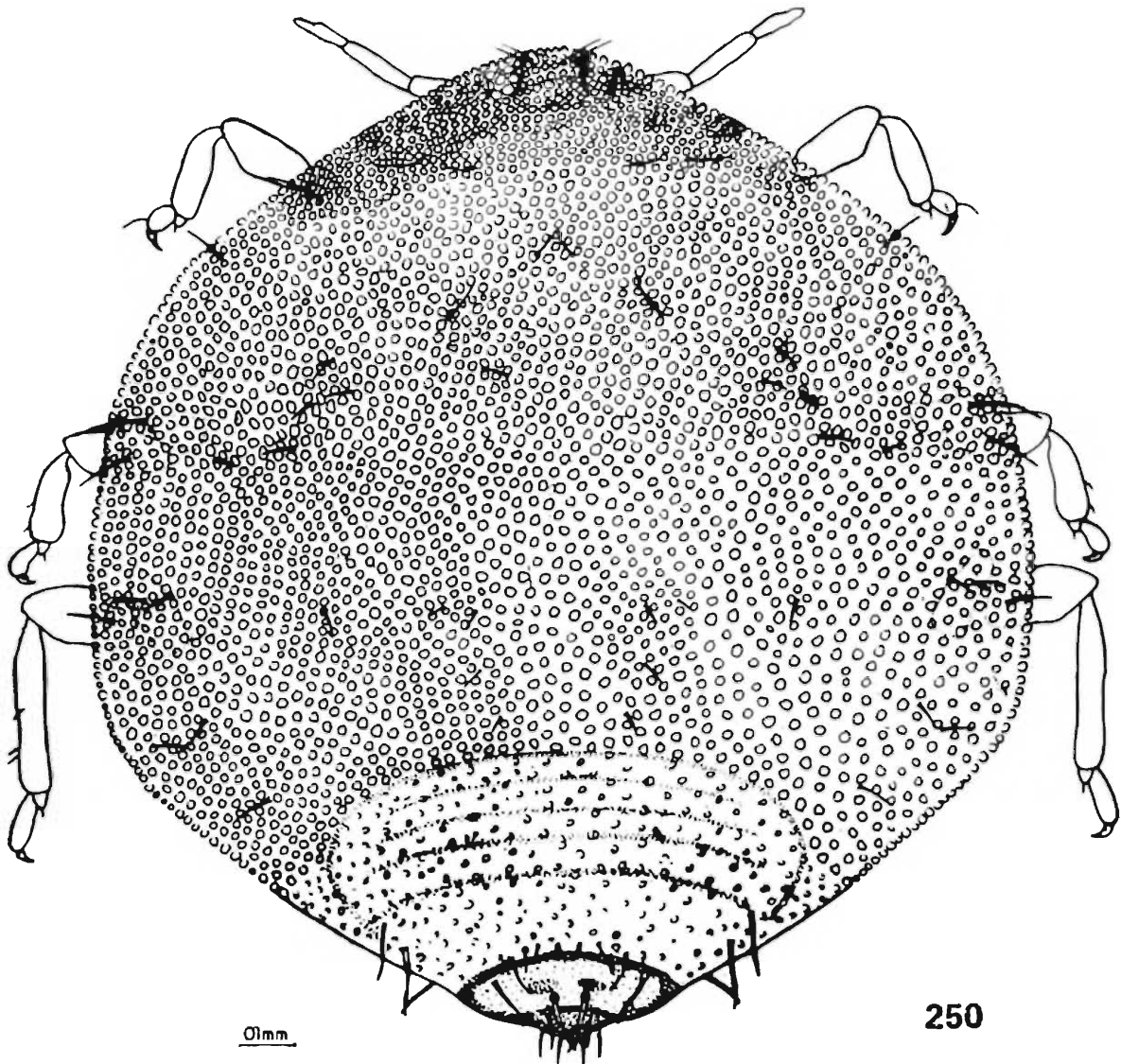
Distribution : India ; China ; Malayasia ; Thailand ; Java ; Japan.

Type-species : *Thoracaphis arboris* van der Goot 1917 ; Co-types deposited in the collections of British Museum (Nat. Hist.), London and D. Hille Ris Lambers, Bennekom, The Netherlands.

38. *Thoracaphis guercifoliae* new species (Figs. 250-256)

1973. *Thoracannrs* sp., Ghosh, A. K., and Raychaudhuri, D. N., *Kontyu* 41 (4) : 493.

Apterous viviparous female : Body light to dark brown, sclerotic, 1.4-1.5 mm long with 1.1-1.2 mm as maximum width. Antennae 3-segmented, a little longer than length of hind tibia, $1.5\times$ as long as the distance between themselves ; segment III with rhinaria placed apart. Ultimate rostral segment acuminate at apex, $1.70-1.75\times$ as long as second segment of hind tarsus. Prosoma densely covered with subcircular, oval or polygonal pustules, subcircular



Thoracaphis gueraifoliae van der Goot. Apterous viviparous female : 250, whole body.

pustules being more abundant on lateral areas ; lateral hairs fine, 0.065-0.080 mm long, up to $3.0-3.5\times$ as long as the basal diameter of antennal segment III. Abdomen (2-7) defined from prosoma, with traces of segmentation along intersegmental areas and with 6 pair of submarginal hairs of similar lengths (0.08-0.10 mm), $3.5-4.0\times$ as long as the basal diameter of antennal segment III ; posteromesial hairs on 7th tergite absent, 8th tergite with 4 hairs. Siphunculi small, porelike. Cauda dusky, semioval, broader than long and bears 7-8 (?) hairs. Subanal plate bilobed, each

lobe bearing a number of hairs. Legs pale ; tarsi 2-segmented with normal claws ; first tarsal segments with 3, 3, 2 hairs.

Colour : Brown to dark brown in life.

Measurements in mm. :

	Length	Width	Antennae
1.	1.4	1.1	0.20
2.	1.5	1.2	0.21
3.	1.4	1.1	0.20

Antennal segments			urs	ht ₂
I	II	III		
0.02	0.03	0.15	0.10	0.62
0.02	0.03	0.16	0.10	0.066
0.02	0.03	0.15	0.11	0.070

(1, ex *Quercus dealbata*, Shillong, Meghalaya, 11.iii. 1970, C.U. Colls., 2, 3 ex *Quercus dealbata*, Shillong, Meghalaya, 25.vii.1972 Z.S.I. Colls.).

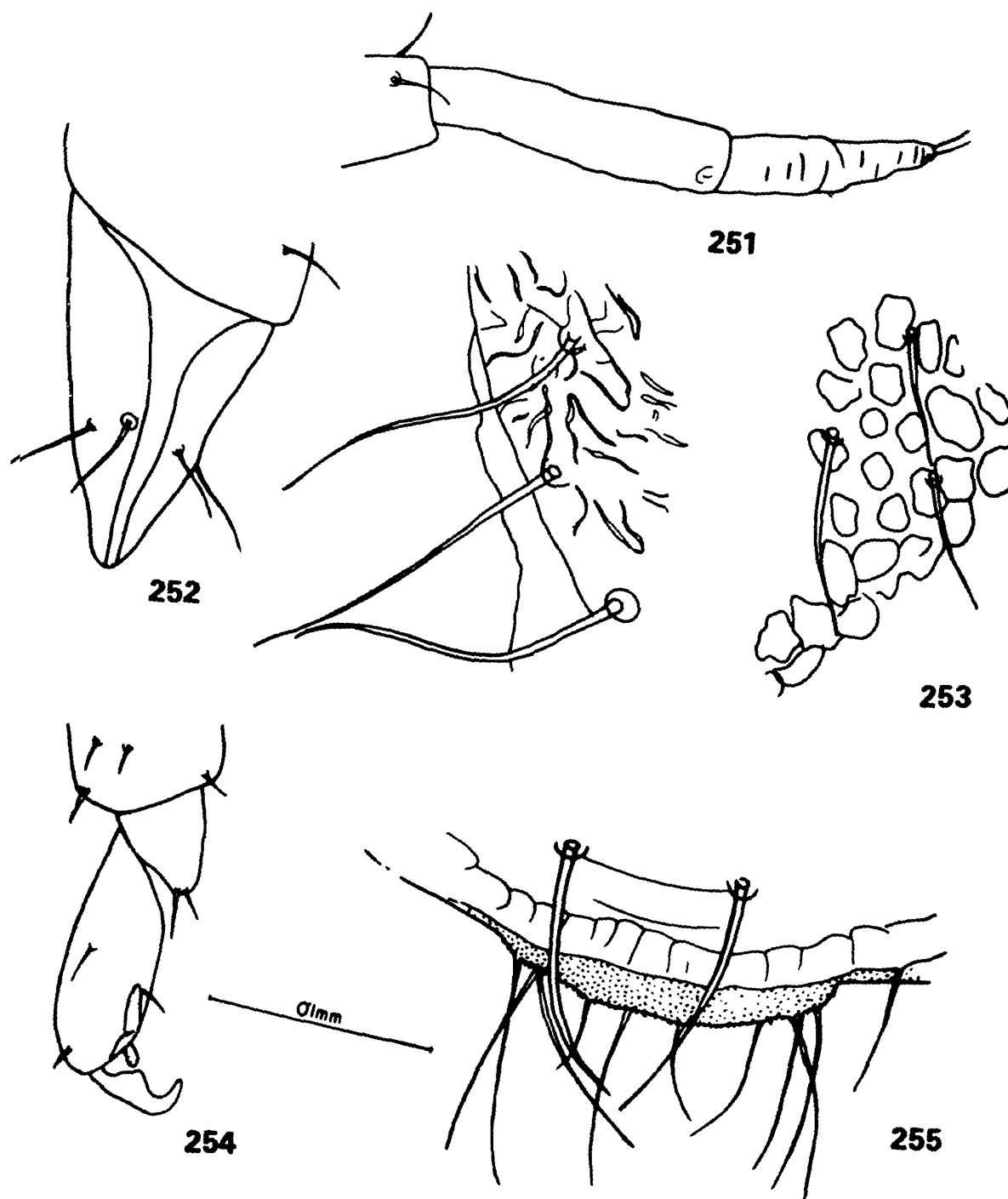
Alate viviparous female : Body 2.1-2.3 mm long with 1.1-1.2 mm as maximum width. Antennae 5-segmented, 0.28-0.29× as long as the body ; flagellum dark, of same length as hind tibia ; segment III with 20-22, IV with 15-17, V with 7-10 annular secondary rhinaria. Abdominal dorsum pale with sclerotic plates around spiracles ; lateral hairs fine, nearly 3.0× as long as the basal diameter of antennal segment III. Siphunculi dark, pore-like. Cauda dusky, constricted at base, wider than long. Subanal plate bilobed. Legs pale, tibiae and tarsi with spinulose striae. Wings dusky ; wing-veins brownish.

Colour : Brown in life.

Measurements in mm. :

	Length	Width	Antennae
1.	2.1	1.1	0.62
2.	2.3	1.2	0.63

Antennal segments			urs	ht ₂
III	IV	V		
0.25	0.16	0.11	?	0.09
0.26	0.16	0.11	?	0.08

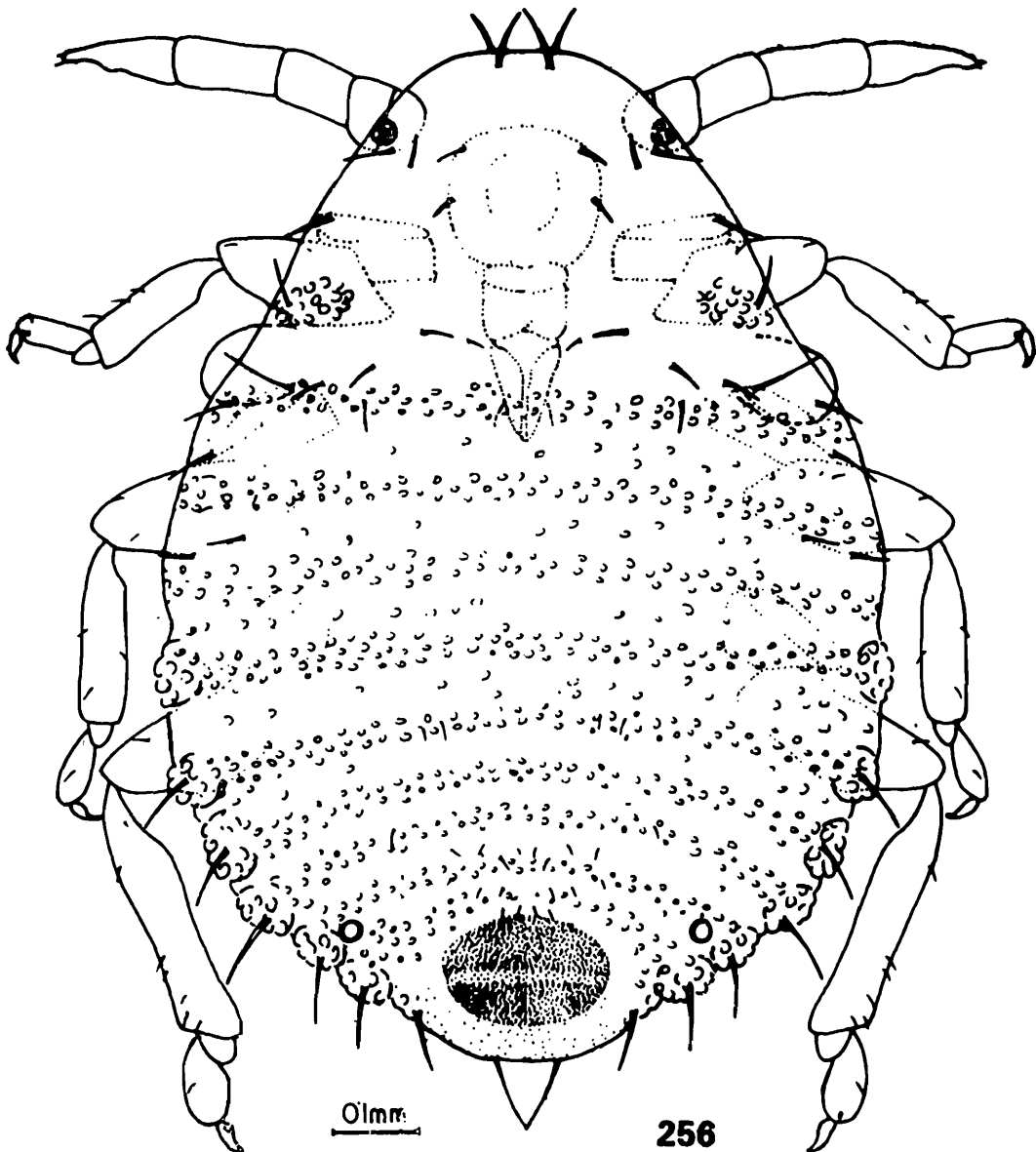


Apterous viviparous female.

251, antenna ; 252, ultimate rostral segment ; 253, part of dorsal pattern and hairs ; 254, hind tarsus, 255, caudal region.

(1, 2, ex *Quercus dealbata*, Shillong, Meghalaya, 26.iii.1972, Z.S.I. Colls.).

Alate nymph : Body 1.2 mm long with 0.62 mm as maximum width, pale. Head separable from thoracic segments, bearing indistinct pustules and fine dorsal hairs which are 0.04-0.05 mm long, longest one on frons up to 0.08 mm long. Antennae thick, stout, 5-segmented, nearly smooth and bearing 1-2 hairs up to 0.023 mm long. Ultimate rostral segment dusky, 0.10 mm long, equal to second segment of hind tarsus with four preapical hair shifted to 0.33 portion, apicad. Dorsum covered with numerous pustules ; each of the thoracic and abdominal segments (1-7)



Alate nymph : 256, whole body.

with variably developed marginal and paired spinal tubercles, marginal ones, each with a fine hair, 0.08 mm long ; 8th tergite with 4 hairs. Siphunculi poriform. Legs pale, stout ; hind tibiae with some sparse striae ; hairs on hind tibiae fine, mostly 0.02-0.03 mm long, 2-3 apical ones up to 0.06 mm long ; second tarsal segment at least with 4 long hairs, upto 0.07 mm long.

Holotype : Apterous aliencola, from *Quercus dealbata*, Shillong, Meghalaya, 11.iii.1970, Coll. S. Sarkar (C.U. Colls.) ; *Paratypes* ; 4 apterous aliencolae and 6 alate viviparous females and 4 alate nymphs, with collection data same as far the holotype (C.U. Colls.) ; 9 apterous aliencolae from *Quercus dealbata*, Shillong, Meghalaya, India, 26.iii.1972, coll. S. Biswas (Z.S.I. Colls).

Discussion : The species was described as *Thoracaphis* sp., by A. K. Ghosh and Raychaudhuri (1973). Eastop and Hille Ris Lambers (1976) recognised only 6 species as valid, under the genus *Thoracaphis* van der Goot, from all of which the present species can be separated by combination of characters viz., pustulation and peculiar chaetotaxy on dorsum. The host record also includes *Pieris ovalifolia*, which seems curious as no other member of Nipponaphidini is known to infest plant of Ericaceae. Extensive collections of the species from *Quercus dealbata* and *Castanopsis* sp., indicate occurrence of aliencolae during the months of March to September around Shillong in Meghalaya, India.

Distribution : India : Meghalaya.

Types : In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India ; eight paratype deposited in National Zoological collections, Zoological Survey of India, Calcutta.

Tribe HORMAPHIDINI

The tribe contains only 2 genera but the number of distinct species appears to be taxonomically difficult. The members of the tribe are recognised by distinct wax gland areas, aleyroidiform generations, absence of siphunculi and narrow and annular rhinaria in alatae. The fundatrices have 3-4-segmented antennae but alatae

may have 3-5 antennal segments. A reduction in normal wing venation may be noted and forewings may have only simple median vein whereas hind wings may or may not have distinct obliques. Typical members of both the genera alternate between galls of Witch-Hazel or *Hamamelis* and leaves of Birch or *Betula*, but some species may be restricted only to *Betula*. Pergande (1901) has described in details the life history of *H. hamamelidis* Fitch and *Hamamelistes spinosus* Shimer and showed that *Hamamelistes* and *Hormaphis*, although occupying the same locality and on the same hosts, are different and distinct genera.

Hormaphis hamamelidis produces galls on the leaves but *Hamamelistes spinosus* produces galls on flower buds and the shape and location of galls could be a most sure index to separate the genera, although both the genera have *Hamamelis* as primary host ; further, biological studies indicate that *spinosus* hibernates on the birch for a longer period and unlike *hamamelidis* could not complete the entire cycle within one year.

HORMAPHIS		HAMAMELISTES 1st year	
WITCH- HAZEL	Winter egg (Oct.) Stem mother(1,2,3,4 stages) (April) 2nd generation (Migrants) (1,2,3,4,5) (May-June)	OVER- WINTERS	Winter egg (June-July) 2nd year Hatch May—June Stem mother (1,2,3,4,5) 2nd generation (1,2,3,4,5) Migrants (1,2,3,4,5)
BIRCH	3rd generation (1,2,3,4,5) 4th „ (Aleurodiform) (1,2,3,4) 5th „ (Aleurodiform) 6th „ Return migrants (August 1,2,3,4,5)	BIRCH	3rd generation (1,2,3,4) 4th „ (1,2,3,4) 5th „ (1,2,3,4) Fall migrants
WITCH- HAZEL	7th generation (1,2,3,4,5) Egg (October)		6th generation (June) Egg

One of the striking features noted during development of *Hamamelistes spinosus* and *Hormaphis hamamelidis*, is the striking resemblance of certain morphs (like third generation/fourth stage) to Aleuroid or Lacaniid genera ; the wax glands and their secretion also often become abundant in earlier stages.

Considering, aleyroidiform generations, fewer antennal segments of fundatrices (3-4), reduction of wing venation, absence of siphunculi, rostrate sexuales and oviparae laying several eggs etc., one can assume that members of these two genera have separated from the main stream of Hormaphidinae during earlier course of evolution, retaining heteroecious holocycle, wherever both the hosts are available or have become Monoecious on Betulaceae ; like most of the primitive aphid groups, natural enemies are rare for Hormaphidini and only one species has been recorded parasitising a subspecies of *Hamamelistes betulinus* (Horvath) i.e. *shirakabae* Monzen, 1927 on *Betula* in Japan.

No species of this tribe was known from India till recent times, when Bhattacharya *et al.* (1983) recorded the japanese species *miyabei* (Matsumura) from *Betula alnoides* in northwestern Himalaya. The species has been recorded both by apterous viviparous and oviparous morphs from the region.

Genus 15. *Hamamelistes* Shimer, 1867

1867. *Hamamelistes* Shimer, H., *Trans. Am. ent. Soc.*, 1 : 284 ; Pergande, Theo. 1901. *U. S. Dep. Agric. Tech. Ser.*, 9 : 25 ; Baker, A.C., 1920 *Bull. U.S. Dep. Agric.*, 826 ; 83 ; Palmer, M., 1953. *Aphids of the Rocky Mountain Region*, 378 ; Heie, O., 1980. *Fauna ent. Scand.*, 9 : 89 ; Type species : *Hamamelistes spinosus* Shimer.
1896. *Tetraxis* Horvath, G., *Wien. Ent. Zeit.*, 15 : 6. Type species : *Tetraxis betulina* Horvath.
1917. *Mansakia* Matsumura, S., *A collection of Essays Nawa, Gifu*, 3 : 59 Type species : *Mansakia miyabei* Matsumura.

Morphology : Apteræ flat coccid-like, aleuroiodiform or 1.2—1.4 mm. long, or normal, globular to broadly pyriform upto 2 mm. long. Antennæ small, 3-segmented and placed ventrally in coccidiform apteræ, 4-segmented and normal in other apteræ and 5-segmented in alatae ; primary rhinaria small, rounded ; secondary

rhinaria in alatae strongly annular. Eyes of 3 facets in apterae. Rostrum stout, reaches beyond fore coxae in adults of normal apterae, well developed in early stage of coccidiform apterae but become much shorter and hardly discernible at later stages ; in alatae, rostrum reaches little beyond fore coxae, ultimate rostral segment shorter than second segment of hind tarsus. Abdominal dorsum in apterae sclerotised ; hairs on dorsum short. Coccidiform apterae have coarse lateral margin. Lined by series of protuberant wax gland cells or tubercles ; dorsum rugose, completely consolidated with short, round ridges in the mid dorsal areas. Siphunculi absent (e.g. *spinosus* and *betulinus*) pore-like (*miyabei*), usually present and poriform in alatae (*betulinus*, *miyabei*). Cauda knobbed. Anal plate bilobed. Legs normal with 2-segmented tarsi in apterae and alatae, but much shorter and at least fore and mid legs without tarsi and hind tarsi without claws in coccidiform apterae ; dorso apical hairs on second tarsal segment long and capitate. Forewings with media unbranched ; hind wings with both obliques ; wings held flat in repose.

Oviparous females are apterous, may vary between 1.0-2.3 mm in length ; ovipare of *spinosus* exhibit distinct segmentation, segmented antennae and paired or duplicated lateral setae with slightly capitate apices (Pergande, 1901) but these are absent in *miyabei* ; dorsal wax gland cells prominent ; rostrum stout, well developed, without accessory hairs ; dorsal hairs long, stout. Siphunculi present (at least in oviparae of *miyabei*) or not discernible. Legs normal with tarsi and claws (in *spinosus*) or without claws and empodium.

Males are small, slender, hardly 0.4 mm long. Antennae 4-segmented. Eyes multifaceted. Rostrum stout, reaching midcoxae, lateral and dorsal hairs long, as in oviparae. Legs normal.

Nymphs in coccidiform apterae exhibit secondary degeneration of appendages, viz., antennae, legs and rostrum from second nymphal stage onward (Pergande, 1901) ; nymphs in normal apterae are reported to develop uniformly except the 'secretory tubercles' on head, thorax and abdomen of 1st instar nymph, which become replaced by hairs from second instar onward (Pergande, op. cit.)

Discussion : The genus was described by H. Shimer (1867) to include two gall forming aphids found on witch-hazel, *Hamamelis* ; of the two species described, *Hamamelistis cornu* is now regarded as *Hormaphis hamamelides* (Fitch) and the type species *spinosus* remains valid for the genus *Hamamelistes*. Riley (1879) partly described *spinosus* erroneously under *Hormaphis* and Oestlund (1887) unknowingly described the return migrants of *Hamamelistes spinosus* from birch (*Betula*) under a new name *Hormaphis papyraceae*. Later, Pergande (1901) dealt most extensively the life history of *H. spinosus* from North America. Almost at the same period, Horvath (1896) described a new genus *Tetraphis* from Europe with a new species *betulina* infesting birch, which is now regarded as *H. betulinus* (Horvath). Matsumura (1917) described as yet another new genus *Mansakia* with new species *miyabei* infesting *Hamamelis japonica* and mentioned its affinity with *Hormaphis*, but Baker (1920) correctly stated that its host and nature of gall would place it close to *Hamamelistis* ; however, use of generic name *Mansakia* continued (Higuchi and Miyazaki, 1969) till Eastop and Hille Ris Lambers (1976) placed it as a complete synonym of *Hamamelistes*. Monzen (1927) probably recorded the same species (*miyabei* Matsumura) for the first time from *Betula cromani* and *Betula platyphylla* var. *japonica*, under a new name, viz. *Hamamelistes shirakabae*. Eastop and Hille Ris Lambers (1976) listed *miyabei* from Japan, as a subspecies of *betulinus* (Horvath) from Europe, but Bhattacharya *et al.* (1983) proposed a new combination and treated *miyabei* (Matsumura) as a distinct species, separable from *betulinus* (Horvath) by the presence of siphuncular pores in the apterous morph. Accepting the latter, the genus *Hamamelistes* can now be considered to be composed of three different species : *spinosus* Shimer from North America, *betulinus* (Horvath) from Europe and Japan, and *miyabei* (Matsumura) from Japan and India.

Biology : *H. spinosus* Shimer, is known to alternate between *Hamamelis* and *Betula* and lives a holocyclic life cycle, in U.S.A. involving 5 generations besides the sexual generation (Pergande, 1901). The winter egg is laid on *Hamamelis*, which on hatching, produce globular petiole gall, which when fully matured appear ornate being covered with long, curved spiny outgrowth. Migrants resulting from second generation, move to *Betula* leaves

where they produce aleyroidiform third generation (Hibernating). The fourth generation resulting from hibernating females produce pseudo-leaf galls (appearing as corrugation) and on maturing give rise to 5th (migratory) generation which migrate back to *Hamamelis* in June to produce males and females of 6th generation, to complete the cycle ; winter eggs are deposited from middle of June to early in July instead of during fall of the year and hatch in the next May or June, remaining dormant from over a year (Pergande, 1901), and as such the cycle involves a 2 years period.

Heie (1980) mentioned that *Hamamelistes betulinus* (Horvath) leads anholocyclic life cycle on birch (*Betula pubesceus*, *B. verrucosa*) in Europe ; ants are also reported to visit the colonies of *betulinus* in Scandinavia. Heie (op. cit) also mentioned that *miyabei* is holocyclic and host alternating in Japan. The finding of both apterous and alate viviparae and also nymphs and apterous oviparous females on the same host, *Betula alnoides* in India, perhaps indicates that *miyabei* may also lead holocyclic life cycle without host-alternation. Fulmek (1957) mentioned about an Ichneumonid parasite of *H. spinosus* in South America.

Distribution : India ; Japan ; Mongolia ; Western Siberia ; Europe ; North America ; South America.

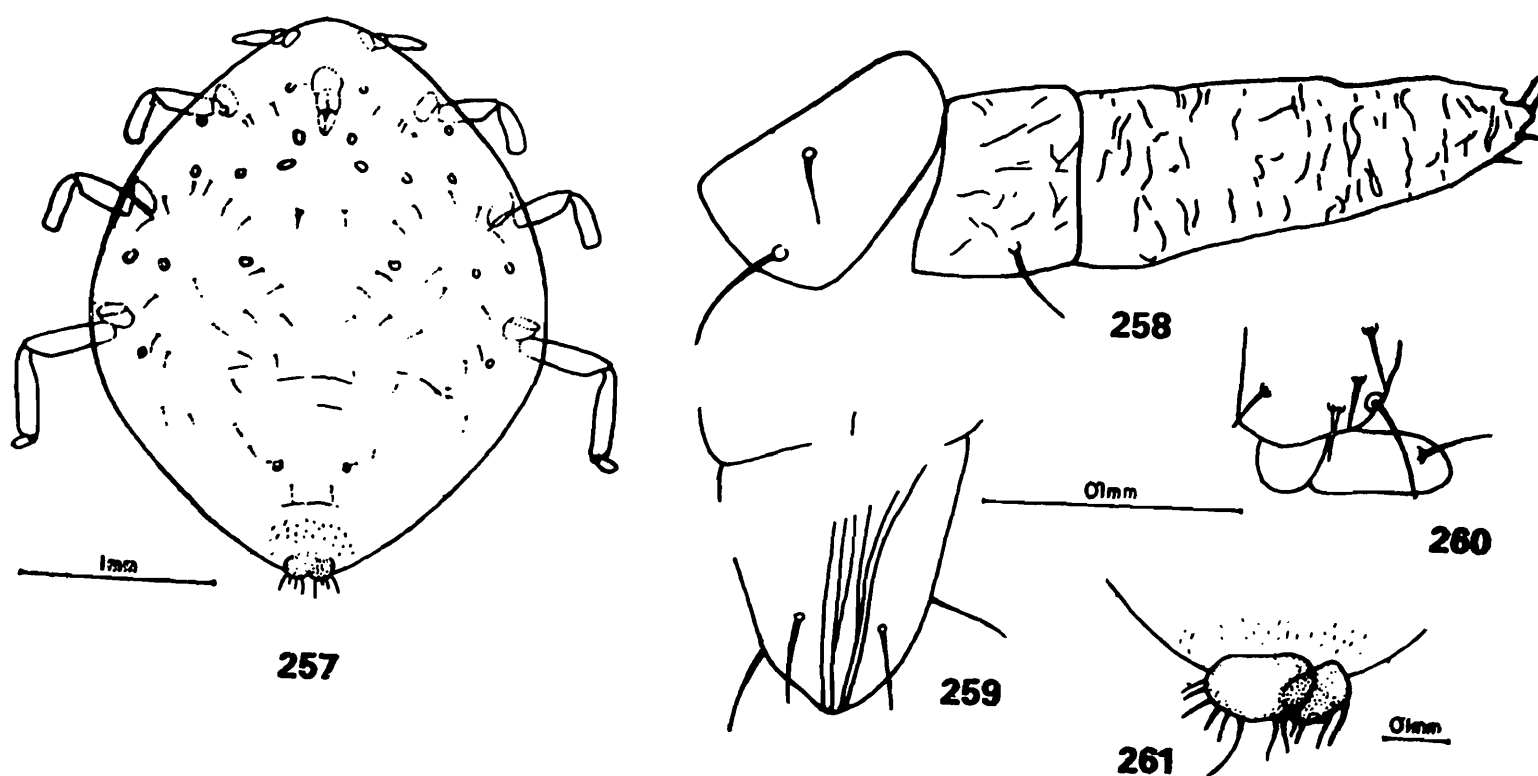
Type species : *Hamamelistes spinosus* Horvath, 1867. Location of the type is not known. Smith and Parson (1978) mentioned Illinois, U.S.A. as the type locality.

39. *Hamamelistes miyabei* (Matsumura) (Figs. 257-261)

- 1917. *Mansakia miyabei* Matsumura, S., A collection Essays for Nawa, Gifu, 3 : 59.
- 1976. *Hamamelistes betulinus miyabei*, Eastop, V.F. and Hille Ris Lambers, D., Survey of the World's Aphids, 212.
- 1983. *Hamamelistes miyabei*, Bhattacharya, D. K., Mandal A. K. and Chakraborti, S., *Entomon*, 8 (1) : 15.

Apterous viviparous female : Body pale, ovoid, 2.33-2.34 mm long with 1.38-1.65 mm as maximum width. Head fused with prothorax, brown on anteromedian region, rest pale ; dorsum

distinctly wrinkled ; dorsal cephalic hairs stout, 0.060-0.066 mm long, with acuminate apices, longest one $1.0-1.2\times$ as long as the basal diameter of antennal segment III. Antennae 3-segmented, (with indistinct suture, denoting division of segments III and IV in one specimen), fuscous brown, distinctly scabrous, $0.10-0.11\times$ as long as the body ; segment I with one, II with 2 fine hairs, 0.023-0.026 mm long, $0.39-0.50\times$ as long as the basal diameter of antennal segment III ; processus terminalis $0.20-0.25\times$ as long as base



Hamamelistes miyabei Shimer. Apterous exule : 257, whole body ; 258, antenna ; 259, ultimate rostral segment ; 260, hind tarsus ; 261, caudal region.

of last antennal segment. Eyes of 3 facets, on dark brown sclerotic areas. Restrum brown, stout, reaches beyond fore coxae, ultimate rostral segment without any accessory hairs. Tergum pale, bearing paired brownish marginal wax glands on posterior portion of cephalothorax, mesothorax and metathorax ; mesothoracic furca with widely separate arms ; similar structure evident also on metathorax. Abdominal dorsum pale with faint, brown, small sclerotic patches bearing spinules ; hairs on the dorsum long, stout with subacute apices, 0.066-0.100 mm long, $1.1-1.6\times$ as long

as the basal diameter of antennal segment III ; 8th tergite with 2 (?) hairs, upto 0.115 mm long, $2.0\times$ as long as the mentioned diameter ; ventral hair thin, fine 0.036-0.050 mm long. Siphunculi poriform with thick chitinized rims. Cauda dark, knobbed, bearing many hairs. Subanal plate bilobed. Subgenital plate with 35 hairs. Legs pale brown with femora scabrous ; hairs always thin, fine, upto 0.040 mm long, two hairs at the tip of hind tibiae thick, upto 0.050 mm long, $0.83\times$ as long as the diameter at the middle of the tibia ; first and second legs without tarsi and hind legs with atrophied tarsi.

Colour : Not recorded.

Measurements in mm :

Length		Width	Antenna	
1.	2.34	1.38	0.24	
2.	2.34	1.65	0.25	

Antennal segments				urs.
I	II	III	IV	
0.040	0.05	0.15	—	0.083
0.040	0.05	0.80	(0.050+0.0130)	—

(1, 2 ex *Betula alnoides*, Bhuinder, Govindghat, U.P., 30.v.1980, K.U.)

Alate viviparous female : Body elongate ovoid, 2.10-2.20 mm long with 1.03-1.10 mm as maximum width. Head dark brown ; dorsal cephalic hairs few, 0.02 mm long, $1.0\times$ as long as the diameter at the constricted base of antennal segment III. Antennae 5-segmented, brown, $0.30\times$ as long as the body ; segment III with series of interconnected striae near the base, equal to segments IV+V taken together, with 21-23 strongly annular secondary rhinaria over its entire length ; segment IV with 13 and V with 7 similar rhinaria ; hairs on flagellum hardly discernable ; process terminalis very small, with 3 apical setae. Rostrum reaches at least forecoxae, ultimate rostral segment $0.78-0.80\times$ as long

second segment of hind tarsus, and without any accessory hairs, but a pair of preapicals placed distinctly apart from the other pair. Abdominal dorsum pale ; spiracles on brown sclerotic plates, hairs on the dorsum of abdomen with acute apices, 0.02-0.03 mm long, $0.90-1.4\times$ as long as the basal diameter of antennal segment III ; 8th tergite with 4 (?) hairs upto 0.04 mm long, $1.7\times$ as long as the mentioned diameter. Siphunculi small-subgenital plate with 28-30 hairs. Subanal plate bilobed, each lobe with 11-13 hairs. Caud with 6-7 hairs. Legs with spinulose striae on tibiae, feebly so on tarsi ; hairs on tibiae stiff, upto 0.020-0.023 mm long, $0.50\times$ as long as the diameter at the middle of the tibia, dorso-apical hairs on second tarsal segments flattened at apices ; empodial hair longer than claws. Forewings with bordered veins, media simple, cubital and anal united at base, hind wings with both obliques.

Colour : Not recorded.

Measurements in mm. :

Length		Width		Antenna	
1.	2.10		1.03		0.64
2.	2.20		1.10		?
III	Antennal segments		urs	ht ₂	
	IV	V			
	0.28	0.13	0.12	0.083	0.106
	0.31	—	—	0.073	0.093

(1, 2 ex *Betula alnoides*, Bhuinder, U.P., 30.v.1980, 30.v.1980, K.U.).

Sexual forms :

Apterous oviparous female : Body 2.30 mm long with 1.1 mm as maximum width. Head fused with pronotum anteromedially brown, rest pale ; dorsum of cephalothorax wrinkled ; cephalic hairs stout, $1.4\times$ as long as the basal diameter of antennal segment

III. Antennae 3-segmented, scabrous, $0.07 \times$ as long as the body ; segment I and II each with 2 hairs ; hairs on flagellum thin and fine ; processus terminalis $0.11 \times$ as long as base of last antennal segment. Rostrum reaches beyond fore coxae, ultimate rostral segment without any accessory hairs. Thorax pale, scabrous. Abdominal dorsum pale, scabrous, spinulose on posterior tergites ; faint brown spino-pleural sclerotic patch present segmentally on abdomen, these becoming darker caudad ; hairs on the dorsum of abdomen long, stout, with flagellate apices, 6-8 on each of anterior tergites, 4 on 7th and 8th tergites, these being $2.3-2.4 \times$, $2.4-2.8 \times$ and $2.9-3.2 \times$ as long as the basal diameter of antennal segment III respectively ; ventral hairs fine. Wax pores large on thorax, small on spinal areas of 1st-4th abdominal tergites ; wax gland cells densealy cover the rest of the abdomen. Siphunculi with brown chitinized rim. Cauda dark with 16-18 hairs. Sub-genital plate with 28 hairs. Legs brown with femora and tibiae sclarous ; hairs on femora short and fine ; fore and mid legs without tarsi, hind legs with atrophied tarsi. Empodium absent.

Colour : Not recorded.

Measurements in mm. :

Length	Width		Antenna
2.30	1.1		0.23
Antennal segments			Urs.
I	II	III	
0.04	0.04	(0.110+0.011)	0.07

(ex *Betula alnoides*, Govindghat, 30.v.1980, K.U.)

Material examined : Five Apterous viviparous females. Two alate viviparous females and one apterous oviparous females from leaf galls of *Betula alnoides*, Bhuinder, Govindghat, Uttar Pradesh, India, 30.v.1980, coll. A. K. Mondal (K.U. Colls.).

Discussion : The species was originally described as *Mansakia miyabei* from *Hamamelis japonica* in Japan by Matsumura (1916). Subsequently, Shinji (1924) described *Thoracaphis betulifoliae* from *Betula platyphylla* var. *japonica* and Monzen (1924, 1929, 1954) described three species, viz., *Mansakia shirakabae* from *Betula erami* and *Betula platyphylla* var. *japonica*, *Mansakia kagami* from *Hamamelis japonica* and *Hamamelistes cristafoliae* from *Betula maximowicziana* respectively. Eastop and Hille Ris Lambers (1976) considered *miyabei* as a subspecies of *betulinus* (Horvath) and listed other species as possible synonyms of *miyabei* (*Kagami*) or nominate species *betulinus* (*betulifoliae* Shinji, *cristafoliae* Monzen, ? *shirakabae* Monzen). Considering the holocyclic host-altering life cycle of *miyabei* (Heie, 198r) in Japan, it is possible that all the five species refer to only one and the oldest available name *miyabei* Matsumura, 1916 should be treated as the valid name ; Shinji's (1924) description, as such, would refer to aleyroidiform, generation on birch.

Bhattacharya et al. (1933) separated *miyabei* from *betulinus* by the presence of siphunculi in apterae in the former (both on Japanese and in Indian material) and absence of the same in the latter. The species produces bivalved, hypophytous leaf folding galls by thickening of leaf blade and upward rolling of the same. The occurrence of viviparae, both apterous, alate and nymphs along with oviparae on *Betula elnoides* in Northwest India suggests that the species may also live anholocyclic life cycle on birch.

Distribution : India ; Japan.

Types : Location of types not known.

Tribe CERATAPHIDINI

The primary host of Cerataphidini, as already stated, is Styracaceae (*Styrax*) and secondary host mostly includes Liliatae (*Araceae*, *Graminae*, *Palmae*, *Zingibericeae*) ; a large number of species however are now only known from Liliatae ; of the genera

under this tribe, *Tuberaphis* v.d.Goot appears to be the connecting link between Nipponaphidini and Cerataphidini, in having flat body like Nipponaphidini genera and remnants of frontal horns as in Cerataphidini genera ; also, *Tuberaphis* occurs on a different host plant, e.g. Loranthaceae, a parasitic plant group belonging to Santales.

Most genera of Cerataphidini (7 out of 11) are monotypic ; species diversity has been noted only in *Astegopteryx* (38 spp.), *Ceratovacuna* (13), and *Pseudoregma* (10). Most of the Cerataphidini genera have frontal horns which are variably developed (except in *Aleurodaphis*), ranging from very short as in *Cerataphis* to long, as in some *Pseudoregma* ; wax glands are variably developed over the dorsum, sometimes being restricted only to lateral margin or in spinal and marginal rows or scattered over the entire dorsum ; in some cases as in *Astegopteryx*, these are restricted to post-siphuncular segments ; rarely these may be completely absent as in the adults of *Pseudoastegopteryx* Raychaudhuri *et al.*, or *Glyphinaphis*. The wax gland cells may be arranged in a group having a distinct margin (*Ceratovacuna*), may be scattered or arranged in rows (*Astegopteryx*) or sometimes only wax pores may be found over the body (*Pseudoregma*) ; however, larvae of many species show complete complement of wax glands even though these may be reduced in adults ; anal plate in all genera are indented or bilobed except in *Ceratolyphina* which has an entire anal plate. It is also unique in having a semioval cauda as opposed to knobbed cauda as in most of the other genera of the tribe ; another interesting morphological character (which was used by Takahashi earlier) is the shape of dorso-apical hairs on first tarsal segment, which may be normal, swollen or funnel-shaped.

Often, gall formers on *Styrax* (about 20 species, cf., Takahashi, 1953) appear different from alienicolae on secondary host and have often been assigned to different genera viz. (1) *Astegopteryx styrocophila* Karsch (on *Styrax*) Syn. *Trichoregma pallida* v.d.G. (2) *Astegopteryx nekoashi* Sasaki (on *Styrax*) Syn. *Ceratovacuna oplismeni* Shinji (on *Oplismenus*) and knowledge of complete life cycle could only remove this confusion. Usually, gall forming Cerataphidini aphids are considered under *Astegopteryx* and *Ceratovacuna* but Hille Ris Lambers (1953) considers the genus

Cerataphis as under the same category, although life cycle of the members of this genus on *Styrax* remain apparently unknown.

As in other host alternating aphids, the embryones inside the migrants may differ from the embryones inside the earlier generations ; the migration cycle of *Astegopteryx* (Syn. *Trichoregma*) remained unknown till H.R.L. (1953) showed that in aphids from Bamboo (*Trichoregma*), some alatae contained embryones with frontal horns, wax glands, and exhibit similar chaetotaxy as those of apterae on Bamboo but other alatae (*Astegopteryx*-like) contained embryones with a chaetotaxy similar to those of apterae in the galls of *Styrax* and had no frontal horns or wax glands ; similar observation was made by him in case of *Cerataphis fransseni* H.R.L. from *Styrax* gall where alatae had embryones of *Cerataphis* type, others of *Astegopteryx* type suggesting a possible alternation of host (i.e. to *Cocos*).

Some features of the nymphs (Takahashi, 1924) of Cerataphidine genera may be considered to follow inter-tribal relationship. In general, apterous forms of members of genera *Pseudoregma* and *Astegopteryx* moult three times and alatae moult 4 times : first instar nymphs of some genera like *Astegopteryx*, *Cerataphis* (dark in adult stage) have pale body, with well developed legs, 3-4-segmented antennae and may crawl over the host plant as against the sedentary darker adults ; acquisition of a gradual sedentary habit with reduction of antennal segments and tarsal atrophy could be noted. Cephalic horns in nymphs may be of two types in some genera like *Pseudoregma*, i.e. pointed or blunt, (as also the claws, large and small) ; eyes in all nymphal instars except in full grown nymph of alate remain three faceted ; antennae may be mobile in some 1st instar nymph but later become immobile (e.g. *Astegopteryx*) ; siphunculi, which are present in all adults may be hardly discernible in first instar nymphs of some species of the genera like *Aleurodaphis*, *Astegopteryx*, *Pseudoregma*, *Cerataphis*. Wax glands may be similar in all instars of apterae and alatae but sometimes nymphs of apterae may have only marginal glands whereas nymphs of alatae may have dorsal wax glands (as in some *Astegopteryx*). Out of all the foregoing nymphal features, affinities may be traced between Hermaphidini and Cerataphidini, especially in the number of moults of apterae and alatae, gradual reduction

of some morphological characters, degree of mobility of adult and nymphs etc. ; in case of apterae, in both Hormaphidine and Cerataphidine genera, the earlier instars have more antennal segments but later adults have same or reduced segments, whereas in case of alatae the reverse situation is noted.

Another interesting feature, of larval dimorphism first noted by Takahashi (1931), had recently been investigated by Aoki (1977), Aoki *et al.* (1977) and Aoki and Miyazaki (1981) need special mention. It has been observed that at least in 3 species of *Astegopteryx*, (*styracicola*, *shitosanensis*, *styraci*), second instar larvae appear in two forms e.g. "normal" and "biters", the biters have distinct frontal spine-like setae and tergal setae and when coming in contact with human, bites and causes irritation ; it has further been ascertained that in all of these three species, "biters" act as soldiers and leave no progeny of their own. *A. jamuritsu* and *A. styracophila* are recorded to bite but occurrence of specialised soldiers are unknown. In four species of *Pseudoregma* (*alexandri*, *bambusicola*, *koshuensis*, *panicola*), some 1st instar larvae appear as soldiers. Such "soldier" like 1st instar nymph has also been noted by Aoki (1977) in *Colophina clematis* and *Colophina arma* Aoki which belong to related subfamily Pemphiginae and these larvae resemble pseudoscorpion like 1st instar-larvae of *Pseudoregma* and also of some *Ceratovacuna* (*japonica*), it may be assumed that perhaps in the latter two genera they also perform the same function. If this is true, then these three genera, viz. *Astegopteryx*, *Ceratovacuna*, *Pseudoregma*, with soldier-like larvae, indicate a process of kin-section, through which these alternate individuals have evolved (Aoki, 1977).

In the region under study, 26 species under 11 genera are known to occur, of which 10 species and a subspecies have been described as new. At least 5 of the 26 species are known from both northern and southern India, while the rest are only known from northern hill areas. The host plant families include Graminae, Loranthaceae, Myrtaceae and Salicaceae. Of the 26 species, 16 species are represented both by alate and apterous viviparone, remaining species being recorded only by apterous viviparone.

Key to the genera of Cerataphidini

1. Frons in both apterae and alatae normal without any process or tubercles.....2

Frons in apterae and often alatae with distinct frontal process or lowly elevated tubercles.....3

2. Body aleurodeform in apterae, with row of wax glands arranged along the entire margin. Head and prothorax fused in apterae, separated from fused meso- and metathorax and fused abdominal segments (1-7) ; 8th segment separated. Dorsal hairs sparse, fine ; ultimate rostral segment longer than second segment of hind tarsus. Subanal plate bilobed. Dorso-apical hairs on second tarsal segment expanded or funnel-shaped at apices. Alatae normal with 5-segmented antennae ; forewings with cubitus and anal fused at base. On Compositae (?), Graminae, Salicaceae.....*Aleurodaphis* van der Goot

Body without lateral wax glands as above. Head fused with prothorax ; abdomen with indistinct segmentation upto 7th tergite. Dorsal hairs stout, arranged in rows. 8th tergite with 6 hairs. Ultimate rostral segment distinctly shorter than second segment of hind tarsus.....*Glyphinaphis* van der Goot

3. Apterae with a crenulated margin of wax glands arranged in a row upto 7th tergite ; 8th tergite with similar wax glands on lateral margin ; alatae without such wax glands. Head in apterae with a pair of long, closely placed frontal processi, sometimes these may be hardly discernible ; in alatae, frontal processi appear as low tubercles. Head in apterae fused with prothorax or with entire thorax ; 8th tergite always free. Cauda slightly constricted. Forewings with media once branched, hind wings with both obliques. Dorso-apical hairs on second tarsal segments with swollen apices. On Styracaceae, Graminae, Palmae, Orchidaceae.....*Cerataphis* Lichtenstein

- Apterae never with marginal wax cells extending into the area of head between the antennae. Body in apterae hardly aleuroidiform. Cauda usually distinctly constricted, if broadly semilunar, then subanal plate entire (*Coratoglyphina*).....4
4. Frons with a median and two lateral blunt tubercles, each with a short spine ; median tubercle deeply notched. Dorsum rugose or with cribiform wax pores. Alate not known. On Parasitic plants.....*Tuberaphis* S. L. Takahashi
- a (b). Abdominal segment, at least basally fused. Dorsum rugose ; marginal wax gland cells extend upto 8th tergite. Cauda wider than long. Subanal plate bilobed. Dorso-apical hairs on second tarsal segments and empodial hairs swollen at apices. On Loranthaceae.....Subgenus *Tuberaphis* Takahashi
- b (a). Abdominal segments distinct. Dorsum with cribiform wax pores present all over, except on 8th tergite. On indet Parasitic plant.....Subgenus *Neotuberaphis* Pal & Raychaudhuri
- Frons with a pair of horn-like processi. Dorsum with variable wax glands.....5
5. Head, thorax and basal seven abdominal segments (1-7) fused. Head with a pair of strongly pointed frontal horns in normal viviparae. Dorsum with dense mosaic-like structure. Antennae and legs atrophied in apterae. Forewings with media simple; hind wings, with one oblique. On Salicaceae.....*Doraphis* Matsumura & Hori
- Head, thorax and abdominal segments (1-7) never consolidated as above. Frontal horns variably developed. Antennae and legs never atrophied. Forewings usually with media once branched, hind wings with both obliques. On Graminae.....6

6. Wax glands in localized groups absent in apterae. Dorsum pale or sclerotic, with minute wax pores or stippled warts or without any wax pores.....7

Wax glands present in localized group on the margin of body in apterae. Tergum usually with distinct segmentation on abdomen. Frontal horns in new born larvae acute.....8

7. Tergum heavily sclerotized covered with rounded stippled warts and minute wax pores.. Abdominal segments (1-7) without distinct border lines. Frontal horns cylindrical, rounded at apices. Head fused with pronotum ; meso-and metanota free ; abdominal segment 8 free. Siphunculi not on hairy cones. Dorso-apical hairs on second tarsal segments with swollen apices.*Chaitoregma* Hille Ris Lambers & Basu

Tergum pale. Frontal horns rounded. Abdominal dorsum with distinct marginal hair bearing sclerites ; 7th and 8th tergite each with 6 hairs. Siphuncular pores bearing long and fine hairs. Nymphs with short, thick and conical frontal horns and distinct wax gland cells. : .*Pseudoastegopterux* M.R. Ghosh, Pal, Raychaudhuri

8. Subanal plate entire. Apterae with numerous wax pores. Marginal wax gland group well defined, composed of large cells. Cauda broadly semilunar. Frontal horns in apterae long, pointed, in alatae reduced. Forewings with media once branched. .*Ceratoglyphina* van der Goot

Subanal plate distinctly bilobed. Cauda broader than long, distinctly constricted at base. 9

9. Pronotum in apterae with two pleural grooves, separated by a median ridge. Vertex covered with irregular denticles ; similar denticles present all over the tergum. 8th tergite in apterae with small wax pores or distinct wax gland cells in oval plates. One dorso-apical hair of second tarsal segments, in both apterae and alatae, with normal apex, other with swollen apex. First instar larvae of two types, one appearing like pseudoscorpion with heavy forelegs and very large frontal horns and claws, other normal.

. *Pseudoregma* Buckton
(= *Paraoregma* Ghosh,
Pal, Ray-chaudhuri

Pronotum without deep pleural grooves, rather evenly rounded in apterae. Wax gland groups variable. First instar larvae of one type, with normal legs. Siphuncular pores with or without hairs..

. 10

10. At least marginal wax gland groups on abdomen with transversely oval cells arranged in a row. Both the dorso-apical hairs on second tarsal segment in apterae swollen at apices; in alatae, one with normal apex. Siphunculi on elevated cones with a few hairs around the base. First instar larvae with thick and strongly conical, frontal, horns...

. *Astegopteryx* Karsch

Wax gland groups composed of rounded cells or some irregularly shaped ones. Dorso-apical hairs on second tarsal segments in both apterae and alatae swollen at apices. Siphunculi poriform, often with a sclerotic rim. First instar larvae with long, slender, pointed frontal horns.

. *Ceratovacuna* Zehntner

Genus 16. *Aleurodaphis* van der Goot, 1917

1917. *Aleurodaphis* van der Goot, P., *Contr. Faune Indes Neerl.*, 1 (3) : 239 ; Baker, A.C., 1921. *Bull. U. S. Dep. Agric.*, 826 : 86 ; Takahashi, R., 1931. *Aphididae of Formosa*, 6 : 92 ; Takahashi, R., 1958. *Akitu*, 7 : 31 ; Raychaudhuri, D.N., Ghosh, M.R., Pal, P.K. and Ghosh, A.K. 1980. *In Aphids of North East India and Bhutan*, 36. Type-species : *Aleurodaphis blumae* van der Goot.

Morphology : Body oval, flat, aleurodiform with head and prothorax fused in apterae, without any frontal horns ; meso- and metathorax fused, 1st-7th abdominal segments fused ; 8th segment free. Margin of body in apterae with sereis of wax-glands and appear crenulated. Antennae 4-5—segmented in apterae, shorter than the length of body ; primary rhinaria small, ciliated ; secondary rhinaria subannular, without any cilia. Eyes of 3 facets in apterae, normal in alatae. Rostrum reaches midcoxae or at most to hind coxae, ultimate rostral segment distinctly longer than second segment of hind tarsus. Dorsum pale, in apterae with many small glands ; dorsal hairs fine, sparse. Siphunculi ring-like. Cauda knobbed. Subanal plate distinctly bilobed. Legs short ; first tarsal segments with 2-3 hairs in apterae, 4,4,4 hairs in alatae ; dorso-apical hairs on second tarsal segments funnel-shaped at apices. Forewings with media once branched, pterostigma elongate, cubitus and anal fused at bases ; hind wings with 2 obliques.

Apterous larvae with wax glands in a single row along the margin, similar to adult apterae.

Discussion : Van der Goot (1917) described the genus with a new species recorded on *Blumea* in Java. Later, Baker (1920) placed this genus under Cerataphidini, and showed its relationship with *Cerataphis* Lichtenstein and *Thoracaphis* van der Goot. Takahashi (1921) recorded the type-species, *A. blumae* van der Goot, in Formosa and subsequently [described Takahashi] (1924)) its first instar nymph. Takahashi (1923) described a new species, *Astegopteryx japonica* from alatae on *Ranunculus* and synonymised the species with *A. blumae* in 1931 ; apparently the confusion was due to nonavailability of alatae of *blumae* and difficulty in correlating apterae and alatae. A second species of *Aleurodaphis* was described by Shinji (1923) as *A. nobukii* from Japan but was later synonymised again with *blumae*. Takahashi (1925) described a second species, *A. mikaniae* on the basis of shorter rostrum, longer antennae and more wax glands (180 as against 120 in *blumae*) and host association with *Mikania scandens*. A third species was described by Takahashi and Sorin (1958) as *A. asteris* infesting *Aster savatieri* differing from *blumae* in smaller size, ratio of u.r.s.

to ht_2 , shorter tarsi and from *mikaniae* in the ratio of antennal segments, colour of body, and fewer wax-glands, besides different host associations. A fourth species, *A. antennata* Chakrabarti & Maity has recently been described from *Bambusa* (?) from North-west Himalaya in India and a fifth, *sinisalices* by Zhang (1982) from *Salix* in China.

As such, the genus is now composed of 5 species largely confined to Compositae in Oriental region, of which only two, viz. *antennata* and *blumae* are known from India. Takahashi (1931) correctly upheld the status of the genus while mentioning that Mordvilko and Börner considered the genus as a possible synonym of *Aste-gopteryx*.

Biology : All the species (except *antennata*) appear to be anholo-cyclic and monoecious. Biology of *blumae* and *asteris* have been worked out in Japan (Takahashi & Sorin, 1958). *A. blumae* produces many generations per year on *Carpesium abrotanoides* in Japan ; alatae *aliencolae* appear during mid August to mid October and each alate produces 5-12 youngs which become apterae viviparae in 10 days after undergoing 3 moults ; Many of the young perish due to inability to get out of amnion covering the body. Alatae lay the youngs with ventral side attached to food plant and these easily come out of amnion. *A. asteris* is reported to produce seven generations a year from March-November without overlapping on *Aster savaterii* ; adult females overwinter on stalks and buds of host and start to lay young from middle of March, larval stage lasting between 10—14 days. No detail biology is known for *Aleurodaphis mikaniae* Tak., except that it forms dense colonies on stalks of *Mikania scandens* during the months of May and June in Formosa ; the alatae of *asteris* and *mikaniae* still remain unknown. No biological data for *antenata* is available and alatae of *antennata* is also not known.

Distribution : India ; Java ; Formosa ; Japan.

Type species : *Aleurodaphis blumae* v.d. Goot, 1917. Location of type material not known.

Key to the species of *Aleurodaphis*

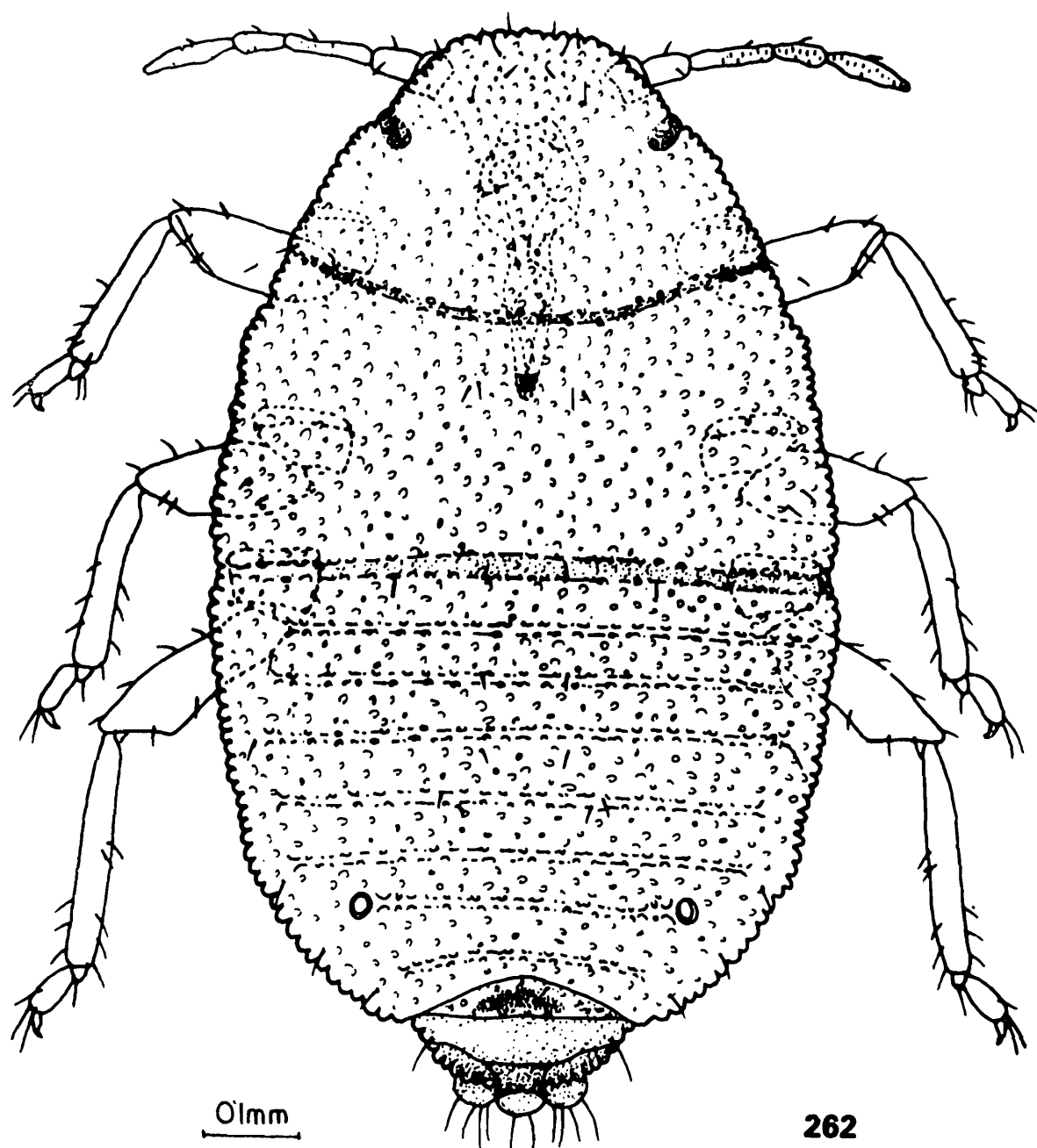
Apterous viviparous female :

- 1(2). Ultimate rostral segment $2.0-3.0\times$ as long as second segment of hind tarsus ; second segment of hind tarsus $2.5\times$ as long as its width at the middle. Margin of body with about 120 wax gland cells. On *Cynoglossum*, *Lantana* (?). *A. blumeae* v.d. Goot
- 2(1). Ultimate rostral segment 0.10-0.11 mm long, $1.2-1.5\times$ as long as second segment of hind tarsus ; second segment of hind tarsus $3.0-3.5\times$ as long as its maximum width at the middle. Margin of body with about 150-196 wax gland cells. On *Bambusa*. . *A. antennata* Chakrabarti & Maity

40. *Aleurodaphis antennata* Chakrabarti & Maity
(Figs. 262-266)

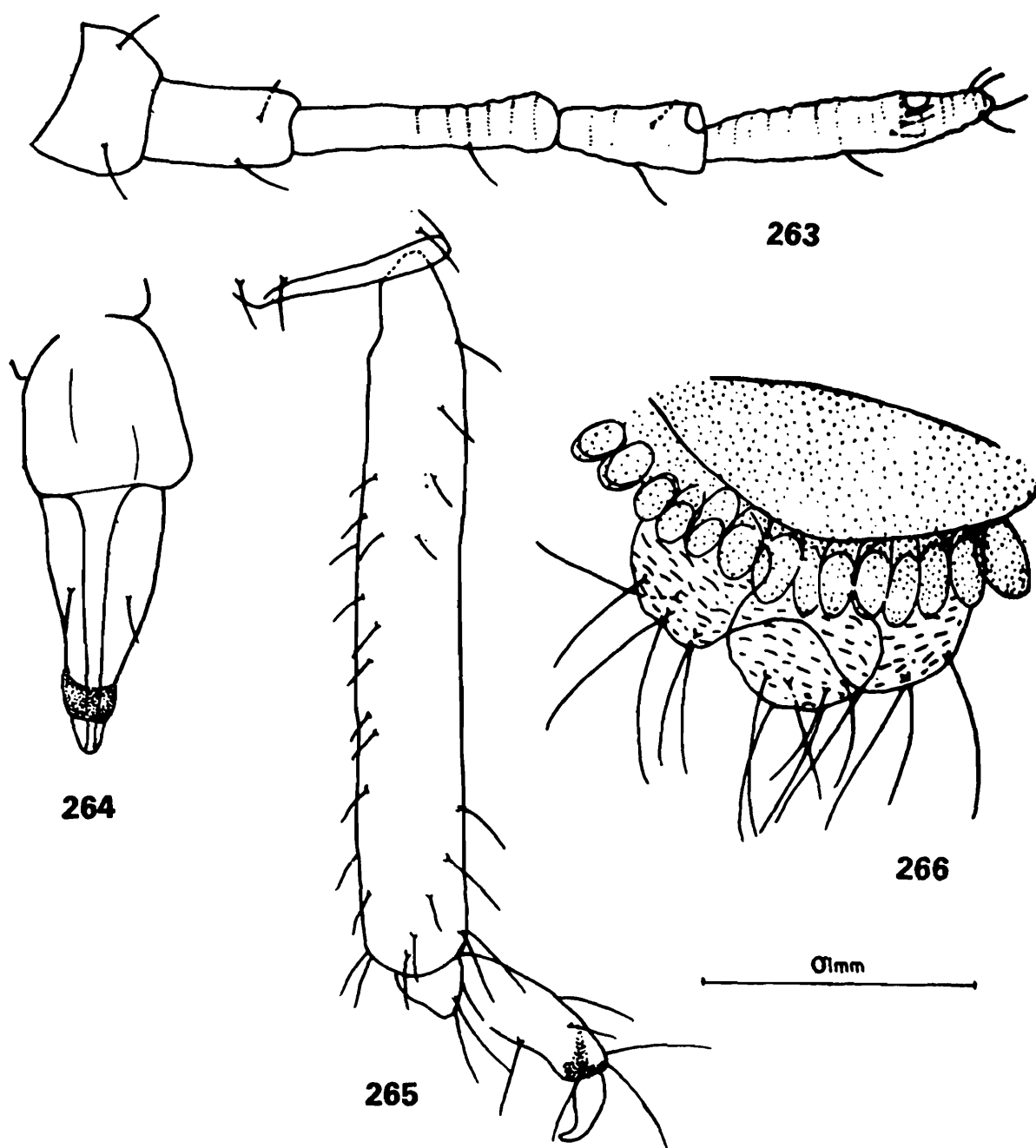
1982. *Aleurodaphis antennata* Chakrabarti, S. and Maity, S.P., *Proc. zool. Soc. Calcutta*, 33 : 56.

Apterous viviparous female : Body aleyrodiform, brown, margin crenulated, about 1.40-1.66 mm long, with 0.67-0.96 mm as maximum width. Head brown to pale brown, fused with pronotum, with four pair of fine hairs on the dorsum, 0.016-0.033 mm long, longest pair on the frons $1.6-2.0\times$ as long as the basal diameter of antennal segment III. Antennae 5-segmented, pale brown, $0.26-0.32\times$ as long as the body ; segment I half as long as wide, with 1 hair, segment II with 2 hairs ; flagellum distinctly imbricated ; hairs on flagellum fine, sparse, longest one on segment III 0.014-0.020 mm long, $0.90\times$ to equal to the basal diameter of the segment ; processus terminalis $0.25-0.30\times$ as long as base of last antennal segment. Rostrum reaches hind coxae, ultimate rostral segment $1.16-1.30$ (1.50) $\times$ as long as second segment of hind tarsus and bears 2 accessory hairs. Abdomen pale to pale brown, segments 1-7 consolidated ; body with papillae in radiating group in the spino-pleural areas, besides in longitudinal row from pronotum to 6th tergite ; hairs on the dorsum of abdomen fine, 1st-5th tergite



Aleurodaphis antennata Chakrabarti & Maity. Apterous viviparous female :
262, whole body.

with one pair of spinal, 1-2 pair of pleural hairs, longest one 0.016-0.020 (0.018-0.022) mm long, $0.95-1.0 \times (1.0-1.2) \times$ as long as the basal diameter of antennal segment III, besides one pair of marginal hairs ; 6th and 7th tergites each with 4 hairs and 8th tergite with 2 hairs, 0.080-0.40 mm long (0.025-0.040 mm), $1.5-2.0 \times$ as long ($1.4-2.3 \times$) the basal diameter of antennal segment III. Spihunculi brown, ring-like with thick sclerotic rim. Cauda dark brown,



Apterous viviparous female: 263, antenna ; 264, ultimate rostral segment ;
265, part of hind leg ; 266, caudal region.

distinctly constricted at base and knobbed at apex, bearing 8-10 hairs including a pair of very long hairs (0.053-0.055 mm). Subanal plate bilobed, each lobe with 5-6 long hairs. Subgenital plate dark brown with 10-12 hairs. Legs thick, stout, concolourous with the body ; femora and tibiae smooth ; longest hair on hind tibiae 0.030-0.050 mm long, $0.90-1.5\times$ as long as the diameter at the middle of the hind tibia and $3.0-3.2$ ($3.5\times$) as long as its width at

middle ; dorso-apical hairs at the apex with funnel shaped apices ; first tarsal segments bear 2, 2, 2 hairs, (4, 3, 2). Body margin with 150-190 (196) wax pores, appearing as crenulations.

(figures in parenthesis from original description)

Colour : Light brown to brown in life.

Measurements in mm. :

	Length	Width	Antenna		
1.	1.66	0.96	0.45		
2.	1.38	0.76	0.39		
3.	1.38	0.76	0.43		

	Antennal segments		urs	ht ₂	Cauda
III	IV	V			
0.13	0.07	(0.11+0.03)	0.10	0.08	0.07
0.11	0.06	(0.10+0.023)	0.10	0.08	0.07
0.12	0.07	(0.10+0.03)	0.11	0.08	0.08

(1, 2, 3 ex Bamboo, Trijuginarayana, U.P., 5.vi.1978, K.U.).

Alate viviparous female : Not known.

Sexual forms : Not known.

Material examined : Five apterous viviparous females from Bamboo, Trijuginarayana, Uttar Pradesh, India, 5.vi.1978, coll. S. Chakrabarti (K.U. Coll.)

Discussion : The species was only recently described as new from Indian region, differing from all other 4 species in the combination of following characters ; ratio of urs to ht₂, number of marginal wax glands, ratio of antennal segment III to V ; and host association, although the host record appears doubtful. The original description mentions F.T.C. as 4, 3, 2 but in all the specimens, obtained on loan from type series, F.T.C. appears to be consistently 2, 2, 2.

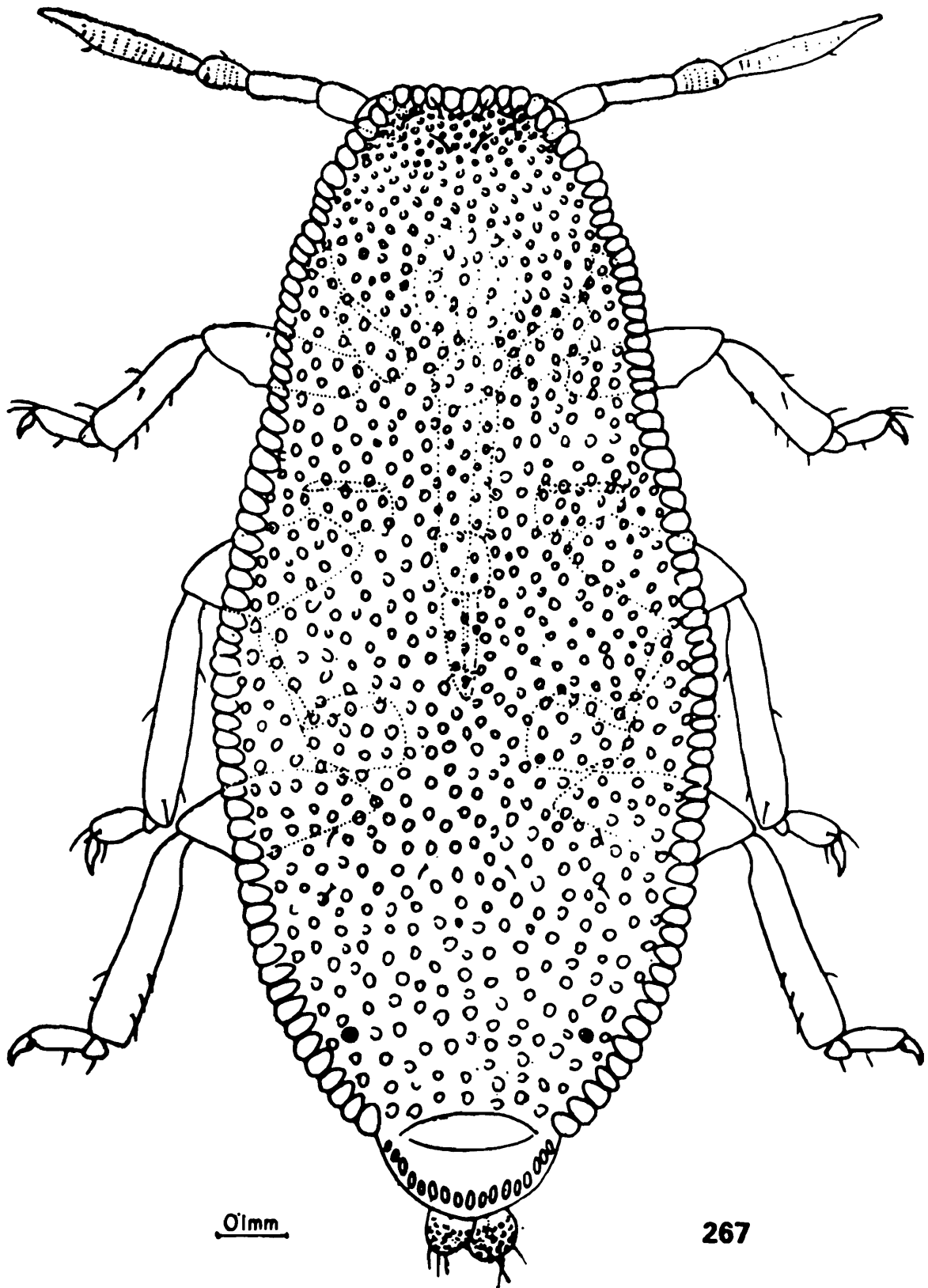
Distribution : India : North-west region.

Types : In the collections of Entomology Laboratory, Department of Zoology, University of Kalyani, India, except 4 paratypes in the collections of D. Hille Ris Lambers, Bennekom, The Netherlands and one paratype in the collections of British Museum (Nat. Hist.), London.

41. *Aleurodaphis blumeae* van der Goot
(Figs. 267-276)

1917. *Aleurodaphis blumeae* van der Goot, P., *Contr. Faune Indes. Neerl.*, (3) : 240.
1980. *Aleurodaphis blumeae*, Raychaudhuri, D.N., Ghosh, M.R., Pal, P.K., Ghosh, A.K., *In Aphids of North East India and Bhutan*, 362.

Apterous viviparous female : Body 1.3-1.5 mm long with 0.52-0.82 mm as maximum width, with wax pores distributed all along the margin. Hairs on dorsum of head with fine apices, 0.023-0.033 mm long, subequal to $1.1\times$ as long as basal diameter of antennal segment III. Antennae 5-segmented, brown, little darker apicad, $0.28-0.33\times$ as long as the body ; segment I shorter than its width, segment II $2.6\times$ as long as its width, each with one hair 0.013-0.016 mm long ; segment III without any hair, IV with 2 hairs and base of segment V with one hair near the base of primary rhinarium ; flagellum distinctly imbricated with spinulose striae ; processus terminalis $0.30-0.33\times$ as long as base of last antennal segment. Rostrum reaches hind coxae, ultimate rostral segment $1.60-1.87\times$ as long as second segment of hind tarsus and bears a pair of accessory hairs. Dorsum with numerous wax pores. Hairs on dorsum of abdomen sparse, short, on anterior tergites 0.006-0.010 mm long, on posterior tergites upto 0.013-0.016 mm long, these being $0.25-0.42\times$ and $0.57-0.62\times$ as long as the basal diameter of antennal segment III, respectively. Siphunculi small, poriform, with thick apical rim. Cauda knobbed, dark, with a pair of long hairs (0.043-0.045 mm long) besides 3-4 shorter hairs. Subanal plate bilobed, each lobe with 5-6 hairs. Legs pale brown, stout, nearly smooth with short fine hairs, longest one on hind tibiae upto 0.040 mm long, equal or little longer than the diameter at the middle of hind tibiae ; second tarsal segment of hind tarsus



Aleurodaphis blumae v.d. Goot. Apterous viviparous female : 267, whole body.

2.25-2.27 $\times$ as long as its width at the middle ; dorso-apical hairs at the apex with funnel-shaped apices ; first tarsal segments each

with 2 long fine hairs upto 0.050 mm long ; second tarsal segment with a fine median hair besides other hairs.

Colour : Brownish in life.

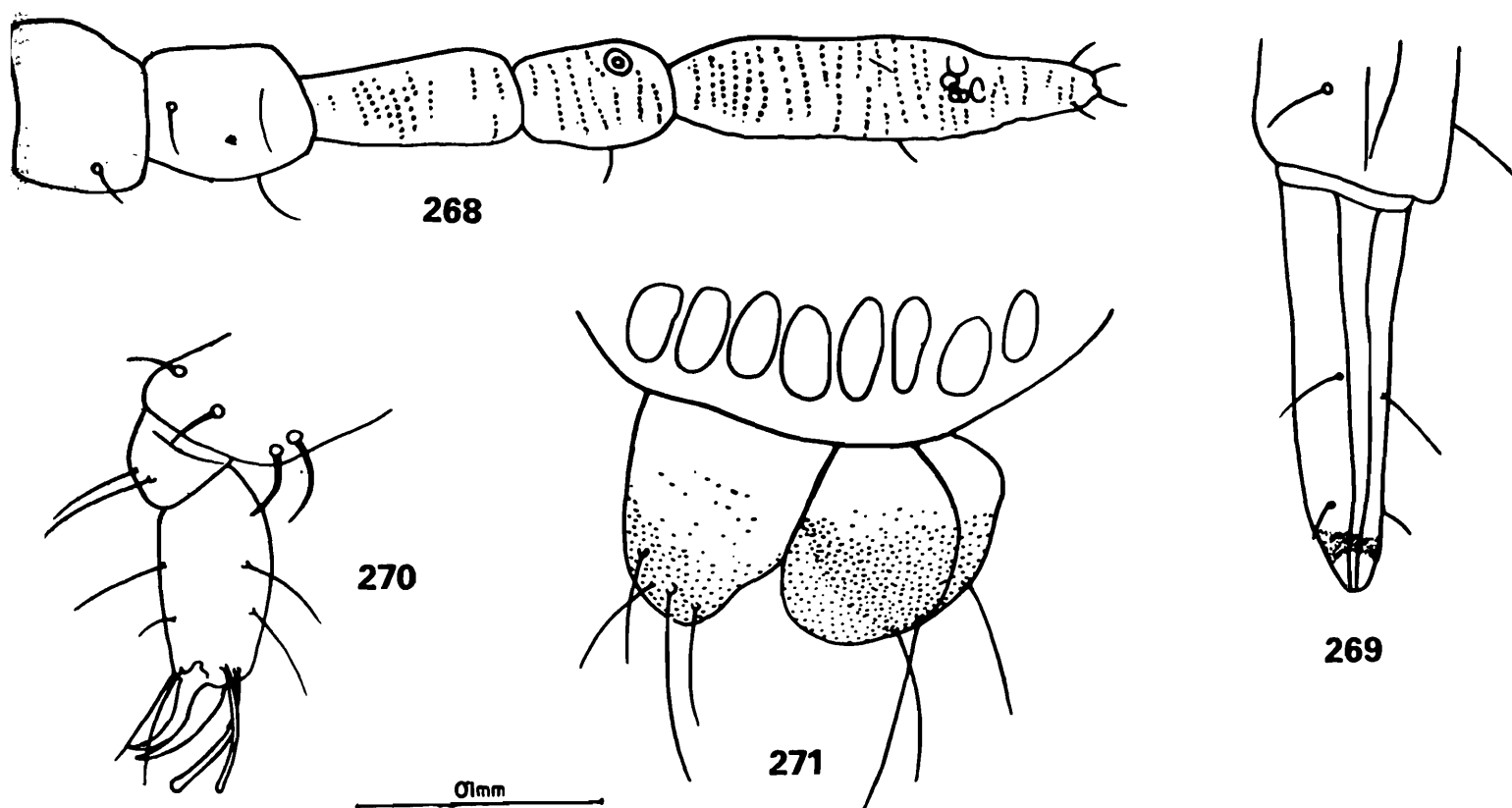
Measurements in mm. :

	Length	Width	Antenna		
1.	1.48	0.82	0.45		
2.	1.30	0.69	0.44		
	Antennal segments			urs	ht ₂
	III	IV	V		Cauda
	0.10	0.07	(0.13+0.04)	0.12	0.08
	0.07	0.05	(0.12+0.04)	0.14	0.08
					0.07

(1, 2 ex Indet Compositae, Shillong, Meghalaya, India, June, 1972, Z.S.I.).

First instar nymph (from Takahashi, 1924) : Body oblong, 0.5 mm long, $2.7\times$ as long as antennae, twice as long as wide. Wax glands small, circular, more than 100 in number arranged in a single row along the margine but absent on dorsum. Head fused with prothorax, with a pair of long fine hairs and 2 short hairs on the frons. Eyes of 3 facets. Antennae 4-segmented, segment I and II each with one hair ; III and IV spinulose, subequal, segment III with a hair near tip. Rostrum reaches beyond hind coxae. Abdominal dorsum with 7 pair of minute spinal hairs. Siphunculi pore-like. Cauda very short, rounded, without constriction, with a pair of long hairs. Subanal plate entire. Legs stout, stouter than antennae, with very long hairs on tibiae and tarsi ; dorso-apical hairs on tarsi knobbed.

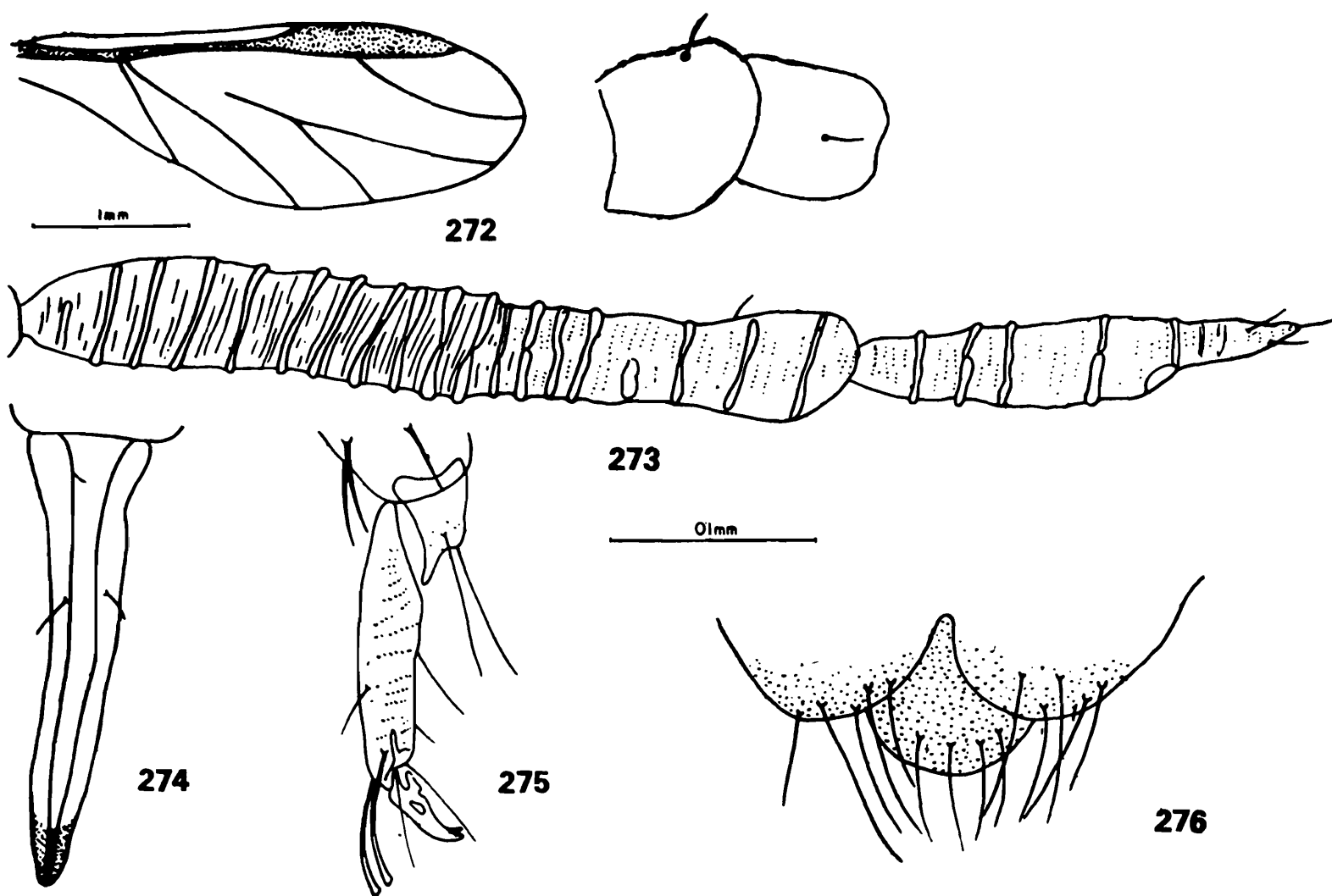
Alate viviparous female : Body 1.63-1.72 mm long with 0.65-0.72 mm as maximum width. Head dark brown with about 10 fine short hairs on the dorsum, 0.013-0.016 mm long, upto equal in length to the basal diameter of antennal segment III. Antennae 5-segmented brown, about $0.33\times$ as long as the body ; segment I



Apterous viviparous female : 268, antenna ; 269, ultimate rostral segment ; 270, hind tarsus ; 271, caudal region ;

with 2 hairs 0.010 mm long, segment II with 1 hair, 0.015-0.016 mm long ; flagellum spinulose ; hairs on flagellum sparse, 1-2 on segment III and IV, upto 0.010-0.015 mm long, longest one on segment III equal to the basal diameter of the segment ; segment III with 15-16, IV with 4-5, V with 5-6 strongly annular secondary rhinaria ; primary rhinaria at the apex of IV and V small semicircular ; processus terminalis 0.25-0.28 $\times$ as long as base of last antennal segment. Rostrum reaches beyond hind coxae, ultimate rostral segment long, slender, little over twice the length of second segment of hind tarsus and bears a pair of accessory hairs at the midlength. Abdominal dorsum pale ; hairs on the dorsum of abdomen sparse, fine, upto 0.083 mm long. Siphunculi on distinct dark brown scleroites. Cauda knobbed, with a pair of long hairs besides 3-4 shorter ones. Subanal plate bilobed, each lobe with 5-6 long hairs, Subgenital plate with 22-24 hairs. Legs thin, brownish, with apices of tibiae sparsely and whole of tarsi densely spinulose ; longest hair on hind tibiae 0.030-0.033 mm long, equal to the width at the middle of the tibiae. First tarsal segments with

3, 3, 3 hairs ; second tarsal segment with a fine, long median hair besides other hairs, 0.043-0.045 mm long ; dorso-apical hairs expanded at apices, upto 0.050 mm long. Wings with dark veins. forewings with pterostigma extending halfway through the length of radial sector ; radial sector gently curved ; media once branched, cubitus and anal united at base ; hind wings with both oblique.



Alate viviparous female : 272, forewing ; 273, antenna ; 274, ultimate rostral segment ; 275, hind tarsus ; 276, caudal region.

Colour : Brown in life.

Measurements in mm. :

	Length	Width	Antenna
1.	1.65	0.72	0.58
2.	1.72	0.65	0.60
3.	1.65	0.71	0.60

III	Antennal segments		urs	ht ₂	Cauda
	IV	V			
0.23	0.10	(0.12+0.03)	?	0.09	0.07
0.23	0.11	(0.12+0.03)	0.21	0.10	0.08
0.23	0.10	(0.12+0.03)	0.20	0.10	0.07

(1, 2, 3 ex *Montana* sp., Changlang, Arunachal Pradesh, 20.xi.70, C. U.).

Sexual forms : Not known.

Larvae : First instar larvae produced by alatae appear yellowish, with 0.38 mm as body length and show 43 wax pores on each side. First instar larvae laid by apterae are larger in size, upto 0.57 mm in length and pinkish in colour and bear 58 wax pores on each side (Takahashi, 1958).

Material examined : Five apterous viviparous females from unidentified, Compositae, Shillong, Meghalaya, India, vi, 1972, coll. S. Biswas and three alate viviparous females from *Montana* sp., Changland, Tirap district, Arunachal Pradesh, 20.xi.1970, coll. A. K. Ghosh, (ZSI Colls.)

Discussion : This species was described from Java on *Blumea* by van der Goot (1917). Subsequently, Takahashi (1921) reported it from Formosa on *Blumea chinensis* collected in May where it infest lower surface of young leaves and tender shoots, which may tend to curl ; apterae are reported to be present in Formosa from February to July (Takahashi, 1923) ; subsequently, first instar nymph of apterous viviparous female was described in details by Takahashi (1924). It is reported to be very common on annual Compositae *Carpesium abrotanoides* in Japan, where apterae overwinter in the crevices of ground level of the host or on the roots ; many generations are produced in a year ; alatae appear from mid-august and start laying young within 2-3 days, each producing 5-12 larvae for two days, which in turn become apterous adult in 10 days after 3 moultings (Takahashi, 1958). Sorin (1966) has shown that this species feed on *Carpesium* by inserting the stylets of rostrum intercellularly in the cortex and suck sap from phloem.

In Indian region, it has been recorded on *Cynoglossum willichi*, *Montana* sp. and *Lantana camera* in eastern states.

Distribution : India : Arunachal Pradesh, Meghalaya, West Bengal ; Indonesia ; Japan ; Korea ; Taiwan.

Types : Location of types not known.

Genus 17. *Astegopteryx* Karsch, 1890

1890. *Astegopteryx* Karsch, *Ber. dt. bot. Geo.*, **8** : 51 ; Baker, A.C., 1920. *Tech. Bull. U.S. Dep. Agric.* **826** : 84 (partim) ; Takahashi, R., 1931. *Aphididae of Formosa of Formosa*, **6** : 85 (partim) ; Hille Ris Lambers D., 1953. *Agric. J. Fiji*, **24** (32) : 2 ; Hille Ris Lambers, D. and Basu, A.N., 1966. *Ent. Ber. Amst.*, **26** : 16 ; Doncaster, J.P., 1966. *Entomologist*, **99** : 157 ; Ghosh, M.R., Pal, P.K., Raychaudhuri, D.N., 1974. *Proc zool. Soc. Calcutta*, **2** : 84 ; Raychaudhuri, D.N., Ghosh, M.R., Pal, P.K. & Ghosh, A.K., 1980. *In* *Aphids of North East India and Bhutan*, 362. Type species : *Astegopteryx styracophila* Karsch.
1903. *Oregma* Buckton, G.B., 1893. *Indian Mus. Notes*, **3** : 87 ; Baker, A.C., 1920. *Tech. Bull. U.S. Dep. Agric.*, **826** : 86.
Type species : *Oregma bambusae* Buckton.
1929. *Trichoregma* Takahashi, R., *Trans. nat. Hist. Soc. Formosa*, **19** : 252.
Type species : *Oregma bambusifoliae* Takahashi.

Morphology : Body 1.0-2.2 mm long. Head nearly smooth. Head and pronotum fused in apterae, with a pair of frontal horns which may be blunt or pointed ; dorsal cephalic hairs long and fine. Antennae short, 4-5-segmented, always less than half the length of body ; hairs on flagellum short and sparse ; secondary rhinaria annular, present in all flagellar segments ; processus terminalis hardly $0.25\times$ as long as base of last antennal segment. Eyes of 3 facets in apterae, normal in alatae, with ocular tubercles appended to the posterior margin. Rostrum reaches at most little beyond mid-coxae, ultimate rostral segment blunt, always shorter than second segment of hind tarsi, usually with a pair of accessory hairs ; abdominal dorsum usually pale in both apterae and alatae. Dorsal hairs long, fine and sparse. Wax glands well developed, variably present on head, thorax and abdomen, closely arranged in marginal row, sometimes present only on 8th tergite [*A. bambusae* (Takahashi, 1935)]. Siphunculi on elevated cones bearing variable number of fine hairs, sometime rather protruding [as an

A. bambusae (Takahashi)]. Cauda distinctly constricted at base, much wider than long, with 6-12 hairs, sometimes a pair of hairs much longer than the others [e.g. *musae* (Takahashi), *pandani* (Takahashi)]. Legs short, slender usually with long fine hairs ; basal segments of fore tarsi with 3-4 hairs, mid-tarsi and hind-tarsi with 2-3 hairs ; dorso-apical hairs on second tarsal segment expanded at apices in alatae, one of these may be blunt or subacute at the apex. Forewings with media once branched, cubitus and anal united at base ; hind wings with both obliques.

Sexual forms unknown. First instar nymph may have immobile antennae, and smaller horns than adults. Siphunculi appear absent or hardly discernible. Wax glands may be similar in all instars of apterae and alatae but sometimes nymphs of apterae may have only marginal wax glands whereas nymphs of alatae may have dorsal wax glands. Larval dimorphism is known in three species (e.g. *styracicola*, *stybacophila* and *jamuritsu*) where 2nd instar nymph from galls may have distinct spine, like frontal setae and targal setae, whereas other forms have normal hairs.

Discussion : The genus, by far one of the largest one in the sub-family, has about 40 species, mostly restricted to South-East asiatic countries ; only 4 species are received in the Indian region. It has been defined by earlier authors based on the gall forming morphs on *Styrax* but once the relationship between gall-forming *Astegopteryx* and bamboo infesting *Trichoregma* and *Oregma* become established (Hille Ris Lambers, 1953. Doncaster, 1966), the concept of the genus has changed. Many of the earlier confusion, largely due to description of species on the basis of gallicolous morphs, have been cleared further with biological investigation on other allied group like Nipponaphidini. Takahashi (1936) has given a useful key to the alate of 15 gall-forming species of *Astegopteryx* and their host plants, three of which have since been shifted to other genera. In this key, Takahashi has included a species, *vandermecrmohri* described from *Styrax* in Sumatra by Hille Ris Lambers and Eastop and Hille Ris Lambers (1976) treated the same species with H.R.L. 1931 as author, it was noted that none mentioned about *Trichoregma vandermecrmohri* Takahashi, 1935 described from *Bombusa vulgares* in Sumatra which obviously comes under *Astegopteryx* ; when this was referred to V.F. Eastop,

he mentioned (in litt.) that "as either or both of them may be synonyms of species described from other morphs, I can't think anything useful can be done until someone in Sumatra sets out their biologies"

Biology : The members of this genus are believed to have evolved through a heteroecious life-cycle alternating between plants of Styracaceae and Graminae. Takahashi (1941) was perhaps the first to indicate that alatae found near old galls on *Styrax* [which resemble those of *Astegopteryx styracophola* Karsch collected in Thailand] resemble those of *Trichoregma* Takahashi, feeding on bamboo and differ from typical alatae of *Astegopteryx* Karsch from the galls on *Styrax* in the siphunculi being located on hairy cones, and cauda being slightly constricted. Till then, life history of any species of *Astegopteryx* was not worked out as also nothing was known about return migrants and secondary hosts. Nevertheless Takahashi (op. cit) suspected that winged forms may be the return migrants of *Astegopteryx*. Later, Hille Ris Lambers (1953) on the basis of transfer experiments of alatae of *Astegopteryx* from two different galls of *Styrax benzion* collected in Java to grasses and *Kentia*, showed that these belong to the same species described [from bamboo] as *pallida* v.d. Goot and *nipae* v.d. Goot, respectively. Embryones of alatae collected on bamboo, appear in two different types, one with frontal horns and wax glands and resembling those inside apterae viviparae on bamboo and others without frontal horn, wax glands and with different chaetotaxy, similar to the embryones inside apterae in the galls on *Styrax*. It was thus established that *Asteopteryx* (= *Trichoregma*) can migrate from *Styrax* to Bamboo and Palms.

Most species of the genus, are however, largely known only from the secondary hosts, specially Bamboo and Palms and some other plants, which include genera : *Amomum*, *Bambusa*, *Cocos*, *Calamus*, *Dendrocalamus*, *Elaeis*, *Kentia*, *Languas*, *Musa*, *Padanus*, *Zalacca* ; a few are known from only primary hosts viz. *jamuritsu* Tak., *lambersi* Tak., *leeuweni* Tak., *roepkii* H.R.L., *rhapidii* H.R.L., *susakii* Tak., *styracicola* (Tak.), *sumatrana* H.R.L., *takenouchi* Tak., *taiwani* Tak *vandermeermohri* H.R.L. etc. ; at least two, viz., species, *aiipae* (v.d. Goot), and *styracophila* Karsch [= *pallida*

(v.d.G.)] are known both from bamboo and palm (secondary host) and *Styrax* (primary host).

Most of the records of infestation on primary host are from the months of October-November ; galls produced on *Styrax* may be distinctive for some species or may appear common for number of species (Takahashi, 1936) ; *styracophila* produces 4-5 small galls, without any basal stalk, in a clusture (fig.); *jamuritsu* produces galls of variable size suspended on the branch of host, these being mostly cylindrical, truncate at tip, hard, with a very large longitudinal cell opening on the distal side. Infestation on secondary hosts are mostly reported between October to May.

Life-history of a few species have been worked out. Takahashi (1924) has described in details the life-history of *A. styracicola* (Taka-hashii) on bamboo in Formosa and noted that while alates have 4 instars, Apterae have only 3 instars.

An interesting feature of larval dimorphism has been noted in second instars which appear in two forms "normal" and "biters" ; the biters have distinct frontal spine-like setae and tergal setae and have the habit of biting with stylets which may cause irritation to human skin. *Astegopteryx jamuritsu*. *A. styracophila*, *A. styracicola* and *A. shitosanensis* are known to bite, but of these, at least for the first two, it has not yet been confirmed whether specialised soldiers occur in these species (Takahashi, 1931), Aoki & Miyazaki (unpub. data, 1981) ; where ever biter act as soldiers, they leave no progeny of their own.

Distribution : India ; Thailand ; Formosa ; Japan ; Malayasia ; Indonesia.

Type species. : *Astegopteryx styracophila* Karsch, 1980. Location of types not known.

Key to the species of *Astegopteryx* Karsch

1. Wax glands distinctly present on head, thorax and abdomen. Each wax gland group with 3-5 cells.....2
- Wax glands absent on head, prothorax and mesothorax or on whole body.....3

2. Body 1.8 mm. long. Frontal horns $1.5\times$ as long as antennal segment II, $0.65\times$ as long as antennal segments I+II. Dorsum without any large dark green patch. Ultimate rostral segment $0.50\times$ as long as second segment of hind tarsus. Each lobe of subanal plate with 9-10 hairs.....*A. bambusae* (Buckton)
 Body 1.0-1.4 mm long. Frontal horns $2.0\times$ as long as antennal segment II, equal to antennal segments I+II. Subanal plate with few hairs on each lobe.....*A. insularis* (v.d. Goot)
3. Wax glands present on metathorax and abdominal segments, each with 1-5 cells. Body small, 1.3-1.7 mm long. Antenna 4-segmented ± 0.33 mm long. Dorsal hairs upto $1.3\times$ as long as basal diameter of antennal segment III. Frontal horns $1.6-2.2\times$ as long as antennal segment II. Ultimate rostral segment $0.60-0.70\times$ as long as second segment of hind tarsus. 8th tergite with about 10 hairs*A. minuta* (v.d. Goot)
 Wax glands absent. Body large $\pm 1.8-2.0$ mm long. Antennae 4-5-segmented, ± 0.49 mm long. Dorsal hairs upto $1.5\times$ as long as basal diameter of antennal segment III. Frontal horns $5/6$ th the length of second segment of hind tarsus. Ultimate rostral segment $0.50\times$ as long as second segment of hind tarsus. Cauda with 6 hairs.....*A. neelgiriensis* David

Apterous viviparous females :

1. Antennae (1.0-1.2 mm) nearly $0.70\times$ times as long the body (1.7-1.8 mm). Antennal segment III 0.71 mm long, more than twice as long as segments IV+V taken together ; segment III with 35-40, IV with 12-14, V with 10-12 secondary rhinaria.....*A. bambusae* (Buckton)
 Antennae (0.65-0.80 mm) less than half the length of body. Antennal segment III semi-equal to little shorter than segments IV+V taken together ; secondary rhinaria variable in number.....2
2. Antennal segment III 0.23-0.28 mm long, equal to shorter than IV+V taken together ; segment III with 25-31, IV with 11-14, V with 7-12 secondary rhinaria.....*A. minuta* (v.d. Goot)

Antennal segment III 0.43 mm long, $1.25 \times$
as long as IV + V taken together ; segment III
with 30-35, IV with 8-11, V with 7-9 secondary
rhinaria*A. neelgiriensis* David

42. *Astegopteryx bambusae* (Buckton)
(Figs. 277-282)

1893. *Oregma bambusae* Buckton, G.B., *Indian Mus. Notes*, 3 : 87.
1917. *Oregma lutescens* van der Goot, P., *Contr. Faune Indes Neerl*, 13 : 197.
1966. *Astogopteryx bambusae*, Doncaster, J.P., *Entomologist*, 99 : 157.

Apterous viviporous female : Body pear-shaped, 1.7-1.85 mm long. Head smooth with a pair of prominent frontal horns, which may be upto $1.5 \times$ as long as antennal segment II and bear 8-10 very short hairs of 0.005 mm long ; hairs on dorsum of head fine, acute, sparse, usually 0.03-0.05 mm long. Antennae 4-segmented, $0.23-0.25 \times$ as long as the body, segment III often showing incomplete divisions ; hairs on the flagellum, sparse, acute, usually 0.015-0.020 mm long, upto $0.50 \times$ as long as basal diameter of antennal segment III ; processus terminalis $0.26-0.28 \times$ as long as base of last antennal segment. Rostrum short, ultimate rostral segment broadly rounded without any accessory hairs, hardly more than half as the second segment of hind tarsus. Tergum smooth, wax glands present on posterior part of cephalothorax in a group of 3 on each side ; meso-thorax with 3-4 and abdominal segments 1st-8th with 4-5 wax glands on each side ; hairs on the dorsum of abdomen sparse, fine with acute apices, upto 0.06 mm long. Siphunculi circular, slightly elevated. Cauda elongate with about 8-10 hairs. Subanal plate bilobed, each with 9-10 short hairs with acute apices. Legs short, hairs on femora and tibiae fine, on tibiae upto 0.04 mm long, first tarsal segments with 3, 2, 2 hairs ; dorso-apical hairs on second tarsal segment expanded at apices.

Colour : Light brown in life.

Measurements in mm. :

	Length	Width	Antennal
1.	1.80	1.18	0.44
2.	1.98	1.24	0.48

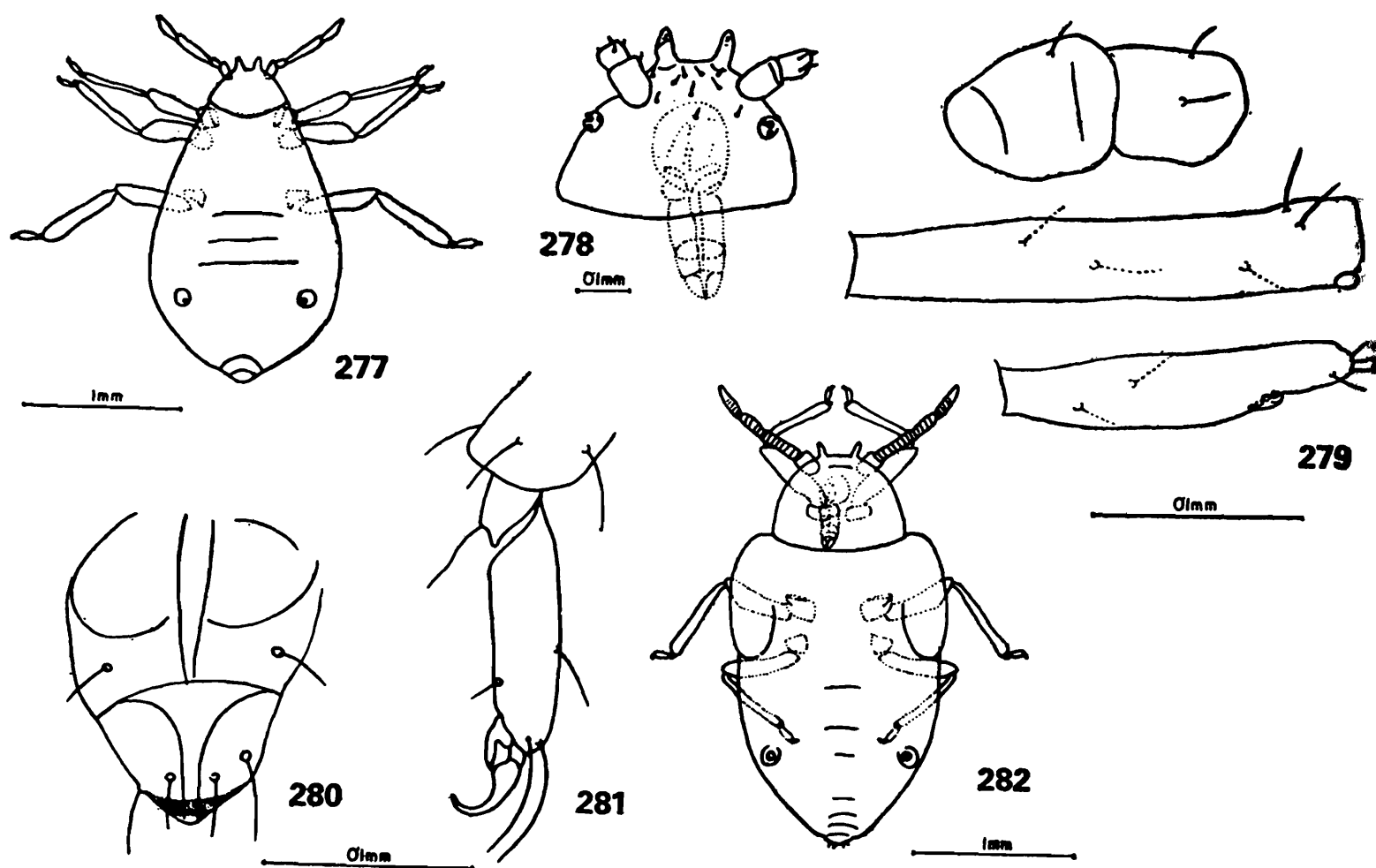
I	II	Antennal segments		urs	ht ₂	Siphun- cular
		III	IV			
0.06	0.05	0.21	(0.09+0.25)	0.06	0.10	0.06
0.07	0.06	0.22	(0.08+0.223)	0.07	0.10	0.07

(1, 2 ex Bamboo, Shillong, 16.v.1974, ZSI).

Alate viviparous female : Not available.

Sexual forms : Not known.

Larva : Not available.



Astegopteryx bambusae (Buckton). Apterous viviparous female : 277, whole body ; 278, head ; 279, antenna ; 280, ultimate rostral segment ; 281, hind tarsus. Alate nymph : 282, whole body.

Material examined : 10 apterae from Bamboo, Shillong, Meghalaya, India, 16.v.1974, coll. A.C. Sukla, ZSI collections.

Discussion : David (1958) recorded alate "*Oregma bambusae*" Buckton from *Bambusa arundinacea*, along with apterae and stated that alate does not exhibit any sclerotisation except for the transverse bars on 7th and 8th abdominal segments ; antenna 5-segmented with segment III (0.71 mm), double the length of IV+V (0.17+0.17) taken together and bearing 35—40 secondary rhinaria. Alate nymph collected with apterae from Shillong, Meghalaya, indicate the following measurements as against measurements for adult alata provided by David (op. cit).

Measurements in mm. :

	Body	Antenna	Antennal segments		
			I	II	III
1.	1.79	1.16	0.71	0.17	0.17
2.	2.00	0.64	0.21	0.10	0.17

(1, ex *Bambusa arundinacea* Kallar, S.K.D.), 2, ex Bamboo, Shillong, Meghalaya, ZSI).

The ratio of antennal segments appear much different and identify of alatae described by David (op. cit) remains uncertain, Doncaster (1966) (1973) designated lectotype on the basis of apterous viviparous female from *Bambusa arundinacea* in Dehra Dun, Uttar Pradesh, India, collected by Cotes and also designated 23 apterous viviparous female, one normal larva and one dimorph larva as 'Paralectotypes' from the same collection but did not mention about alate morph. This entire series form the part of material of which Buckton (1893) based his new species "*Oregma bambusae*" and Doncaster (1966) opined that what Buckton (1894) and van der Goot (1917) described as alate *bambusae* is actually *Pseudoregma bambusicola* (Takahashi). These aphids form colonies on terminal shoots and secrete profuse waxy secretion. No ant-attendance is known. Period of occurrence is recorded in winter months upto May.

Distribution : North west and North east India ; South India (?).

Types : Buckton (1893) did not designate any types. Doncaster (1966) designated lectotype and paralectotypes, which are all deposited in the collections of British Museum (Nat. Hist.), London [Nos. 52, 53, 53a, 54, 55, 56, 532 of Buckton's collections].

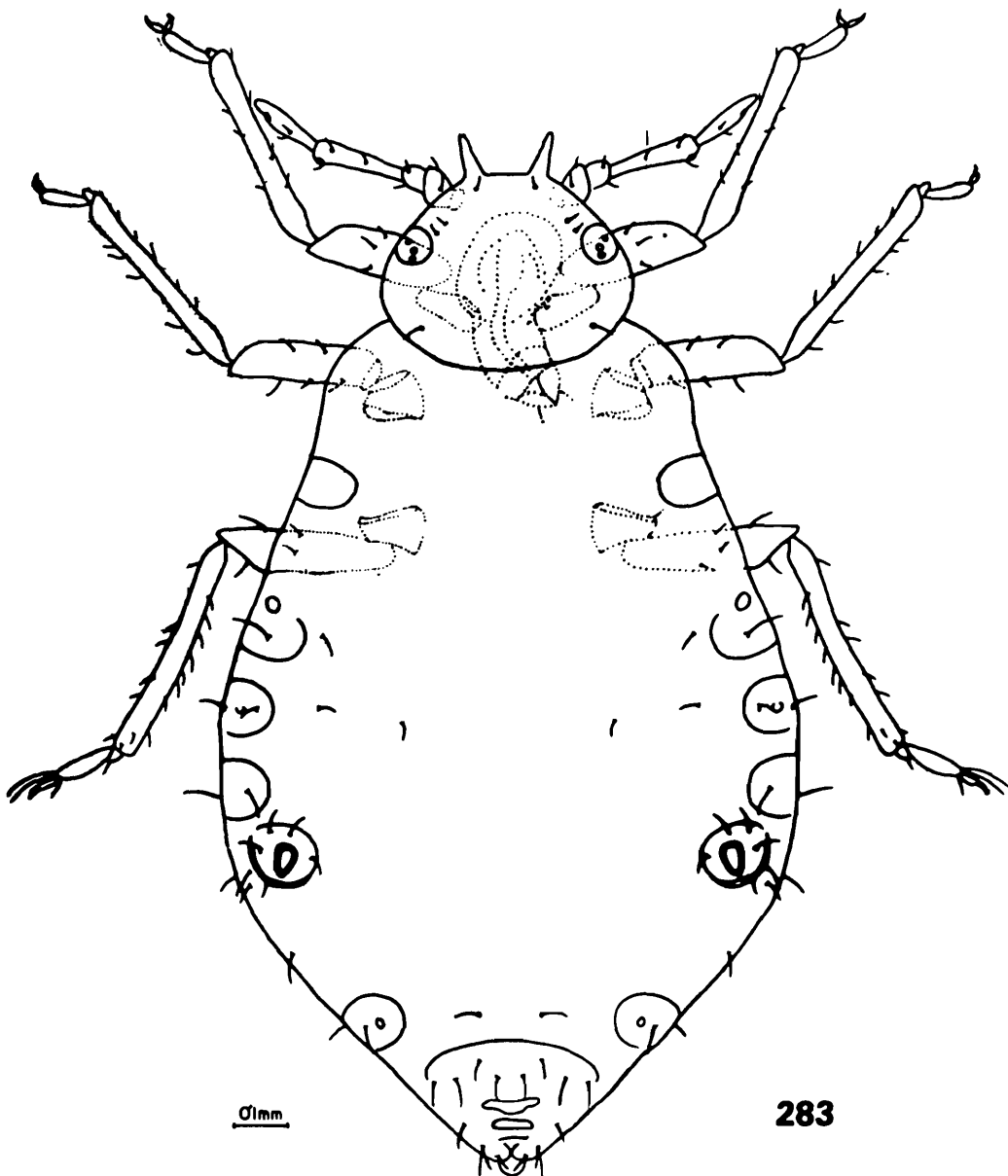
43. *Astegopteryx insularis* (van der Goot)
(Figs. 283-289)

1912. *Cerataphis insularis* van der Goot, P. *Tijd. v. Ent.* LV, 325.
1917. *Oreguca insularis*, van der Goot, P., *Contr. Faune Indes Neeri.*, 1, 3, 186.
1929. *Oregma mysorensis* Theobald, F.V., *Entomologist*, 62 : 199.
1930. *Oregma mysorensis*, Krishnamurti, B., *J. Bombay nat. Hist. Soc.*, 34: 215.
1931. *Trichoregma insularis*, Takahashi, R., *Aphididae of Formosa*, VI, 98.
1958. *Astegopteryx mysorensis*, David, S. K., *Ind. J. Ent.*, 20 (2) : 125.

[Indian material not available, description based on material from Java]

Apterous viviparous female : Body pale with 1.38-1.51 mm, long 0.89-0.96 as maximum width. Frontal horns slender, rounded at apex, 0.060-0.050 mm long, about 0.16-0.17× as long as the antennae. Dorsal cephalic hairs fine, 0.033—0.044 mm. long, 1.4—2.0× as long as the basal diameter of antennal segment III. Antennae 4-5-segmented, 0.21-0.23× as long as the body ; hairs on antennae fine, sparse, not more than 1-2 on any segment, 0.013-0.16 mm long ; shorter or almost equal to the basal diameter of antennal segment III ; flagellum nearly smooth ; processus terminalis 0.24-0.27× as long as base of last antennal segment. Rostrum reaches near mid-coxae ; ultimate rostral segment stout, 0.30× as long as the second segment of hind tarsus and without any accessory hairs. Dorsum pale bearing marginal wax gland cells in group, as follows ; a pair of cells on each side at base of rostrum ; 3-4 cells and each side of pronotum, 3 cells on each side of mesonotum and 3-4 cells on each side of metanotum ; marginal glands present on 1st-7th tergite, each with 3-4 similar cells ; 8th tergite with 5-6 cells on each of two gland group extending to pleural region ; wax gland cells always arranged along the length, trapezoideal, rectangular,

or partly ovoid in shape ; dorsal hairs fine upto 0.04-0.06 mm long ; lateral hairs arising from marginal gland cells areas, long, fine, upto 0.056 mm long. Siphunculi round with a thick flange, on elevated cones bearing 8-9 hairs. Anal plate bilobed, each lobe with 6-7 long hairs. Legs short, pale brownish ; hairs on tibiae acute, upto 0.033-0.036 mm long, equal to the diameter at the middle of the tibiae ; first tarsal segments with 3, 2, 2 hairs.



Astegopteryx insularis v.d. Goot. Apterous viviparous female : 283, whole body.

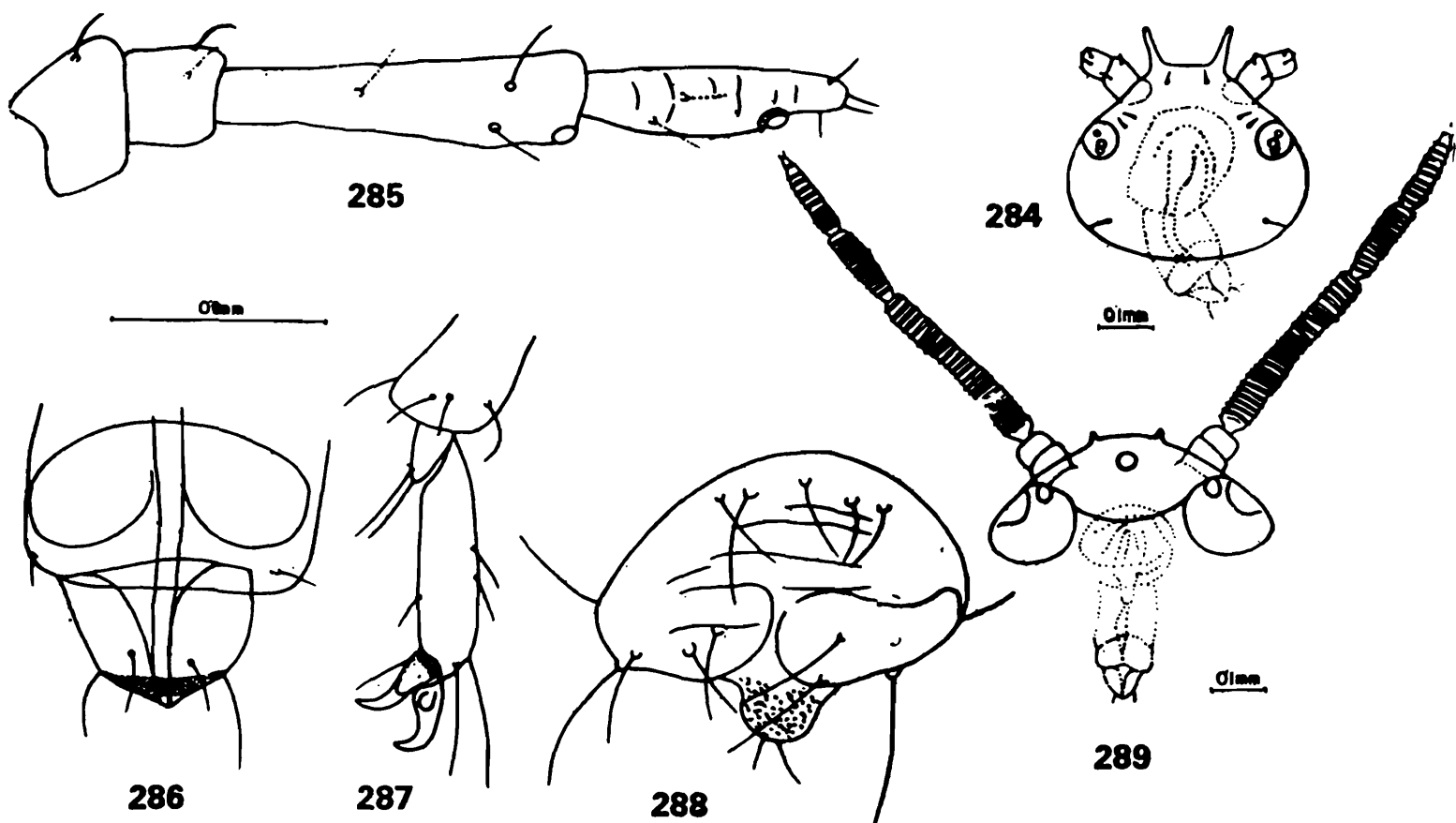
Colour : Yellowish green with a mealy fringe in life.

Measurements in mm. :

	Length	Width	Antenna
1.	1.38	0.87	0.27
2.	1.51	0.96	0.31

	Antennal segments			urs	ht ₂
I	II	III	IV		
0.03	0.04	0.10	(0.066+0.016)	0.05	0.08
0.03	0.04	0.15	(0.083+0.023)	0.05	0.08

(1, 2, ex Bamboo, Java, 25.iv.1950, BMNH Colls.).



Apterous viviparous female : 284, head ; 285, antenna ; 286, ultimate, rostral segment ; 287, hind tarsus ; 288, caudal region. Alate viviparous female : 289, head and antennae.

Nymph (early stage). : Body 0.57 mm long with 0.27 mm as maximum width. Frontal horns appear more pointed, 0.043 mm long. Dorsal cephalic hairs fine, 0.023-0.040 mm long. Antennae dusky brown, 4-segmented, 0.17 mm long, 0.30×as long as the body. Rostrum reaches mid-coxae, ultimate rostral segment rounded near apex, 0.046 mm long, 0.60×as long as the second segment of hind tarsus (0.076 mm). Dorsum pale ; dorsal hairs fine, lateral hairs up to 0.040 mm long ; wax gland groups as in the adult but cells much smaller (0.016-0.006 mm) ; wax gland cells on 8th tergite not evident. Siphunculi small poriform, not clearly discernible. Cauda with 2 hairs. Legs stout, dusky brown.

Colour : Green in life.

Measurements in mm. :

Length		Width		Antenna	
0.57		0.27		0.17	
Antennal segments				urs	ht ₂
I	II	III	IV		
0.02	0.03	0.07	(0.04+0.02)	0.04	0.07

(ex Bamboo, Java, 25.iv.1950, BMNH Colls.).

Other morphs : Not available.

Material examined : Many apterae and nymphs from Bamboo, Bonnowuso, 250 m, Java, 2.iv.1950, Coll. F. W. Rappard, det. DHRL, BM 955-550.

Discussion : The species originally described from Java, has been recorded under several names. Krishnamurty (1930) while describing *O. mysorensis* mentioned the former's closeness to *O. insularis* but differing in having 4-segmented antennae ; *O. insularis*, as can be seen may have both 4-5-segmented antennae. In view of characteristic horns, nature of wax gland cells and other characters, it is now considered under *Astegopteryx* following Doncaster (1966) and Eastop and Hille Ris Lambers (1976). The species is known to infest bamboo in southern India, specially

at higher elevation (David, 1958) and is not attended by ants. First and second instar nymphs appear greenish all over.

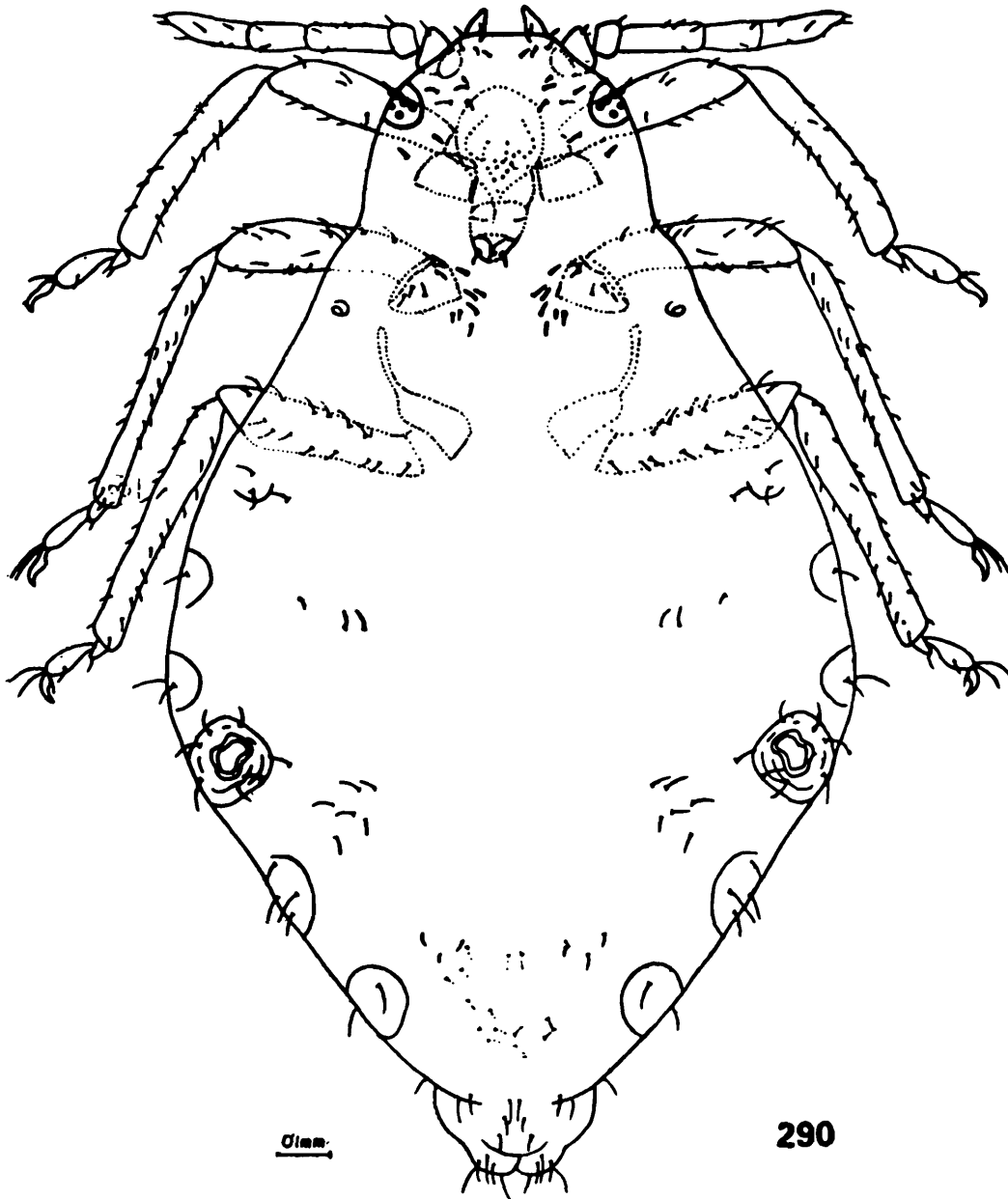
Distribution : India ; Java.

Types : Location of types is not know.

44. *Astegopteryx minuta* (van der Goot)
(Figs. 290-294)

1917. *Oregma minuta* van der Goot, P., *Contr. Faune Indes Neerl.*, 3 : 201.
 1958. *Astegopteryx minuta*, Kanakaray, David, S. K., *Indian J. Ent.*, 20 (2) : 125.
 1961. *Astegopteryx minuta*, Basu, A.N., *Sci. Cult.*, 27 : 456.
 1974. *Astegopteryx minuta*, Ghosh, M.R., Pal, P.K. & Raychaudhuri, D.N., *Proc. zool. Soc. Calcutta*, 27 : 85.
 1980. *Astegopteryx minuta*, Raychaudhuri, D.N., Ghosh, M.R., Pal, P.K., & Ghosh, A. K. Aphids of North east India, Bhutan, 364.

Apterous viviparous female : Body 1.3-1.7 mm long with 0.90-1.2 mm, as maximum width. Head and prothorax fused, dusky, smooth. Frontal horns conical, $1.5-2.2\times$ as long as antennal segment II and bearing 5-6 minute hairs. Hairs on dorsum of head somewhat stiff, 0.016-0.023 mm long, hardly $0.70\times$ as long as basal diameter of antennal segment III. Antennae dusky, 4-segmented but with indication of segmentation on apical 0.40 portion of segment III ; hairs on the antennae sparse, acute, segment I with 3, II with 2, III with 4-5, basal part of IV with 2 hairs, these being 0.016-0.023 mm long ; processus terminalis darker, $0.20-0.24\times$ as long as base of last antennal segment. Rostrum extends hardly beyond fore coxae ; ultimate rostral segment short, stout, wider than long, $0.60-0.70\times$ as long as second segment of hind tarsus and without any accessory hairs. Abdominal dorsum pale bearing paired marginal sclerites on 1st-7th segments, each with one single hair on pre-siphuncular segments and 2 hairs on others, these being 0.040-0.060 mm long, $1.2-2.0\times$ as long as basal diameter of antennal segment III ; hairs on the dorsum of abdomen with acute apices, 0.033-0.050 mm long, $1.2-1.5 (-2.7\times)$ as long as the mentioned diameter ; 7th abdominal tergite with a pair of spinal hairs besides 4 on marginal sclerites ; 8th tergite with 8 hairs, 0.066-0.073 mm long, $2.3-3.0 (-4\times)$ as long as the mentioned diameter. Siphunculi on dark sclerotic cone bearing



Astegopteryx minuta (v.d. Goot). Apterous viviparous female : 290, whole body.

7-9 long, thick, acute hairs. Cauda broader than long, basally constricted, with 6 hairs. Subanal plate bilobed, each lobe with 5-6 fine, acute hairs. Wax glands faint, sometimes hardly discernible, with 1-3 cells, arranged marginally on metathorax and abdominal segments 1st-7th ; 8th tergite with two spino-pleural wax glands each with 4-5 elongated oval cells. Legs pale slender, with tarsi dusky ; hairs on hind tibiae, 0.023-0.026 mm long, 0.7-

0.8 × as long as the diameter at the middle of hind tibia. First tarsal segments with 3, 3, 2 or 3, 2, 2 hairs.

Colour : Yellow or pale brown with transverse diffused streaks of green (David, 1958).

Measurements in mm. :

	Length	Width	Antenna			
1.	1.79	1.24	0.39			
2.	1.50	1.13	0.33			
3.	2.0	1.20	0.42			

	Antennal segments			Sipn.	urs.	ht ₂
II	III	IV	V			
0.04	0.04	0.20	(0.09+0.023)	0.08	0.06	0.09
0.05	0.04	0.16	(0.07+0.019)	0.08	0.05	0.08
0.04	0.04	0.22	(0.09+0.023)	0.06	0.06	0.09

(1, 2, 3, ex *Bambusa* sp., Kalimpong, 28. iv. 1969, C.U.).

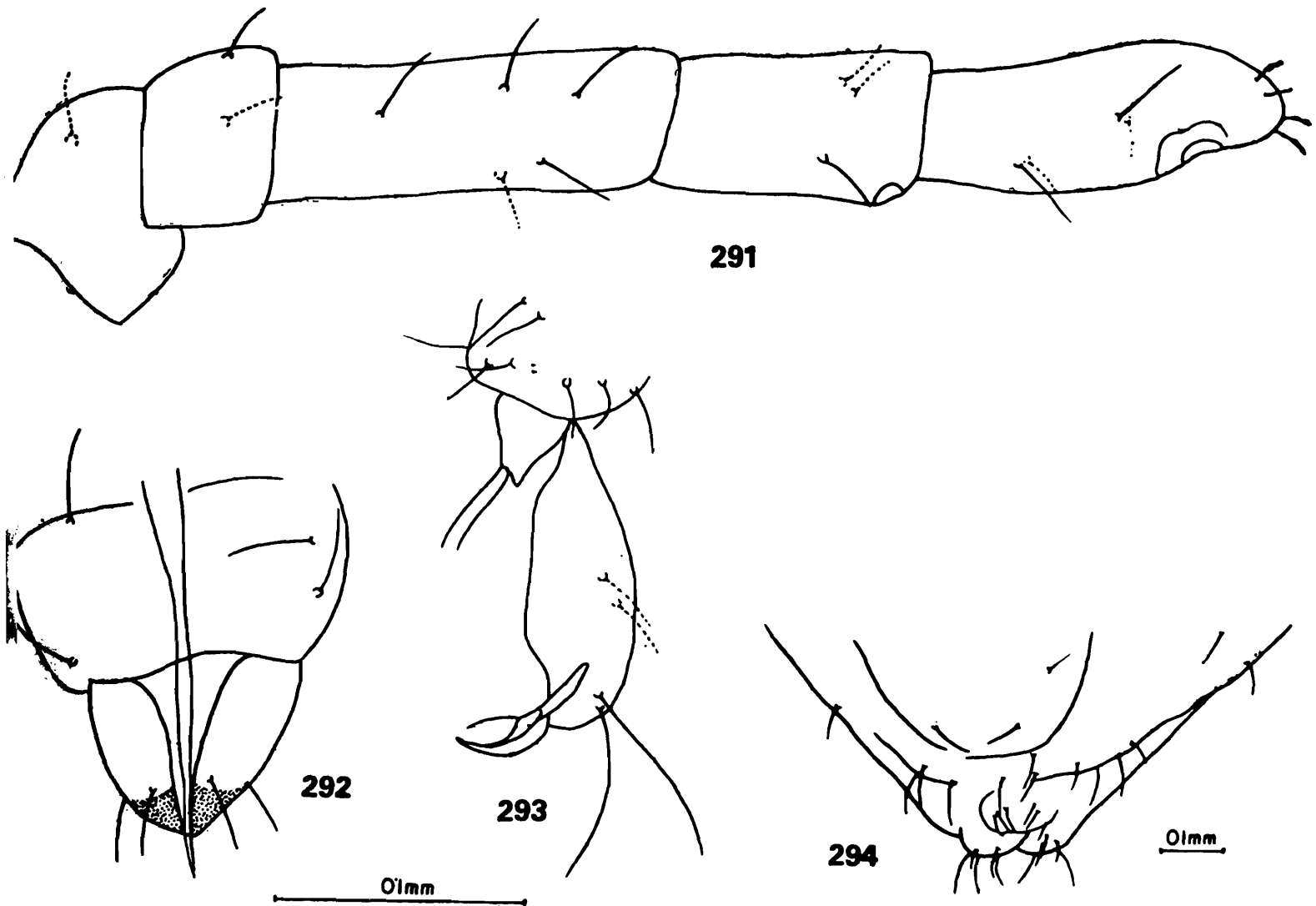
Alate viviparous female : Body 1.6—1.9 mm long with 0.08—1.00 mm as its maximum width. Head dark brown anteriorly, rest brown ; hairs on dorsum of head fine, longest one equal to the basal diameter of antennal segment III. Frontal hairs short, coincidental, blunt with about 8—10 minute hairs. Antennae 5-segmented, basally brown, darker, apically, 0.35—0.45 × as long as the body ; segment I with 2 hairs, II with 2 hairs ; longest hair on segment III up to 0.5 × as long as the basal diameter of the segment ; secondary rhinaria annular ; segment III with 25-31 (24-28), IV with 11-14 (7-10), V with 11-14 (7-12) secondary rhinaria ; processus terminalis 0.14—0.16 × as long as the base of last antennal segment. Abdominal dorsum pale, bearing pale brown marginal sclerites on 1st—7th, 7th and 8th segments each with a transverse spino-pleural band-like sclerites, hairs on dorsum of abdomen fine, longer one occurs on posterior tergites ; 7th tergite with 6 hairs and 8th tergite with 8 hairs, these being 1.4—1.5 × and 2.0—3.0 × as long as the basal diameter of antennal segment III, respectively. Siphunculi on dark brown sclerotic cone bearing

short, fine hairs. Legs smooth with femora pale brown to distinctly brown, tibiae and tarsi little paler ; first tarsal segments with 3, 2, 2 hairs. Wing venation normal.

Colour : Brownish in life.

Measurements in mm. :

	Length	Width	Antenna
1.	1.80	0.94	0.68
2.	1.75	0.92	0.66



Apterous viviparous female : 291, antenna ; 292, ultimate rostral segment ; 293 ; hind tarsus ; 294, caudal region.

Antennal segments			urs	ht ₂	Siph.
III	IV	V			
0.28	0.13	(0.14+0.02)	0.05	0.09	0.06
0.26	0.13	(0.14+0.02)	0.06	0.09	0.06

(1, 2, ex *Bambusa* sp., Kalimpong,—xi. 1971, C.U.).

Nymph : Not available.

Sexual forms : Not known.

Material examined : Several apterae and alatae collected from Bamboo, Kalimpong, Darjeeling District, West Bengal in the months of November—December, 1969-1971, (C.U. Colls.).

Discussion : This species infests undersurface of leaves of host plants. Pale green apterae with dark green streaks or patches and scanty, wax secretion can be noted in life. In West Bengal and Nagaland it has been recorded during November-December and also in April-May, it is also known from Coimbatore in South India. It is reported to occur allthrough the year and alatae are found in July when maximum number of insects are noted. In both northeastern and southern region, ant attendance is not uncommon. No noticeable damage to foliage has been reported.

M. R. Ghosh *et al.* (1974) stated that *A. lutescens* (v.d. Goot) may be recorded as synonym of *minuta* but *lutescens* is now regarded as a synonym of *bambusae*.

Distribution : India : Arunachal Pradesh, Manipur, Meghalaya, Nagaland, West Bengal, Sikkim, North India ; Indonesia.

Types : Location of types not known.

45. *Astegopteryx neelgiriensis* David
(Figs. 295-301)

1958. *Astegopteryx formosana neelgiriensis* David, S.K., *Indian J. Ent.*, 20 (3) : 179.
1976. *Astegopteryx neelgiriensis*, Eastop, V.F. and Hille Ris Lambers, D. The survey of the World's Aphids, 96.

Apterous viviparous female : Body 1.65-1.95 mm long, with 1.07-1.20 mm as maximum width. Frontal horns slender, pale, equal to the length of (± 0.076 mm) of antennal segments I+II together. Head with 3 fine hairs on each side, placed antero-laterally to the base of antenna and four hairs placed postero-medially to the base of antennae, these being 0.040-0.050 mm long, 1.3-1.66 $\times$ as long as the basal diameter of antennal segment III. Antennae 5 (—4)-segmented, 0.20-0.25 $\times$ as long as the body ; segment I, 1.5 $\times$ as broad as its length, segment II nearly as long as its width, each bearing one short hair, 0.010-0.013 mm long ; flagellum nearly smooth ; hairs on flagellum sparse, 1-2 on each segment, longest one on segment III 0.013 mm long, 0.40-0.44 $\times$ as long as basal diameter of the segment ; processus terminalis 0.16 $\times$ as long as base of last antennal segment. Rostrum reaches mid-coxae, ultimate rostral segment up to 0.81 $\times$ as long as second segment of hind tarsus and without any accessory hairs. Abdominal dorsum pale ; hairs on the dorsum of abdomen long, fine, ± 6 per segment, an anterior tergites 0.040-0.50 mm long, on posterior tergites 0.056-0.060 mm long, these being 1.6-1.9 $\times$ as long as the basal diameter of antennal segment III ; 8th tergite with 8 long fine hairs, 0.076-0.080 mm long, up to 2.7 $\times$ as long as the mentioned diameter. Siphunculi pale with large apical pores, surrounded by 9-10 long fine hairs. Cauda dusky, knobbed, with 6 (?) hairs. Subanal plate bilobed, each lobe with 5-6 hairs. Legs pale, tibiae slender, hairs on hind tibiae 0.023-0.040 mm long, upto 1.3 $\times$ as long as the diameter at the middle of hind tibia ; first tarsal segments with 3, 3, 3 (?) hairs.

Colour : Yellow in life (David, 1958).

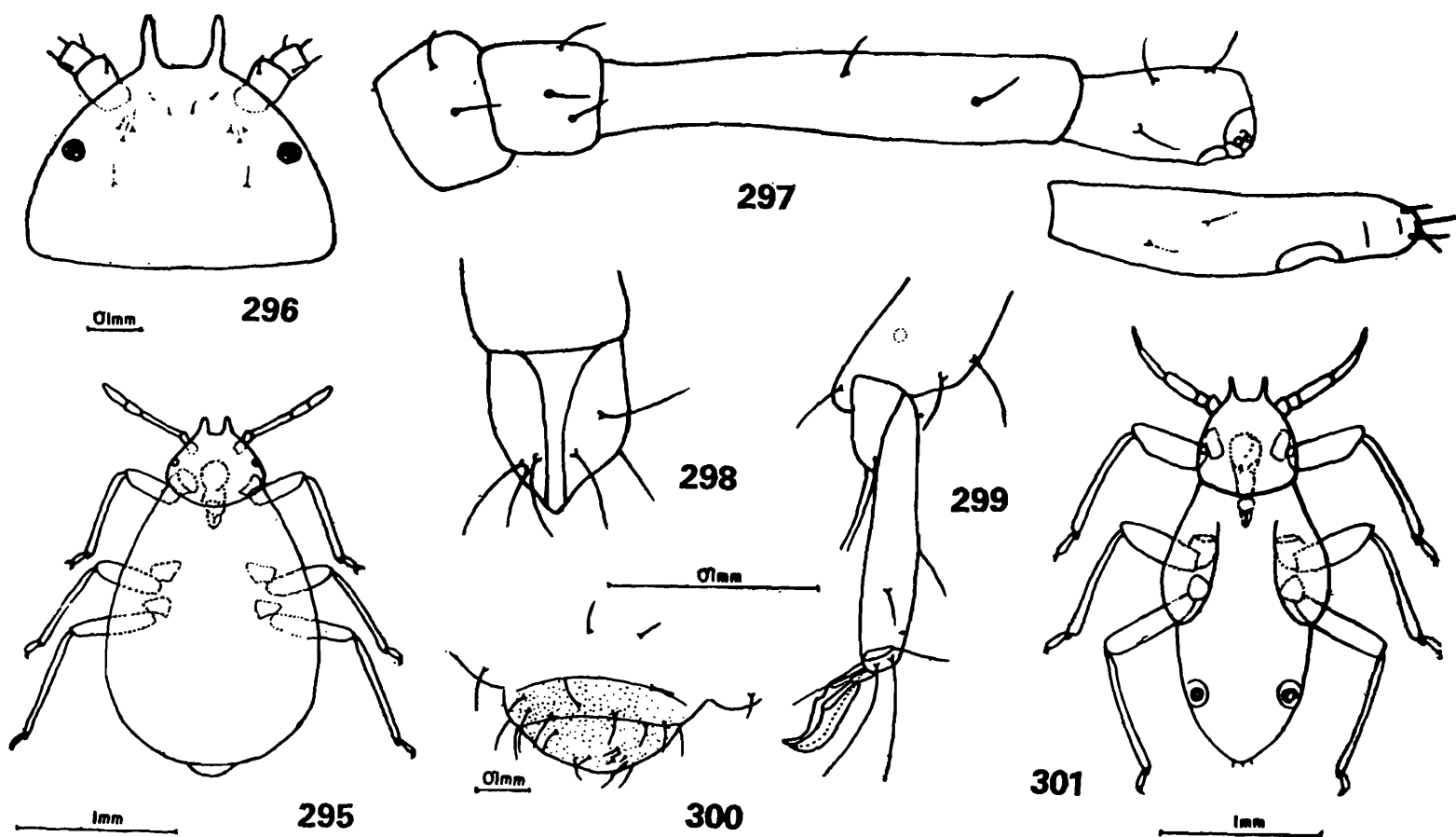
Measurements in mm. :

	Length	Width	Antenna
1.	1.96	1.20	0.48
2.	1.65	1.07	0.43

III	Antennal segments		urs.	ht ₂
	IV	V		
0.18	0.09	0.12	—	—
0.16	0.07	(0.103+0.016)	0.07	0.90

(1, from David ; 2 ex *Bambusa* sp., Coonoor, 18.iv.1953, ZSI).

Alate viviparous female : (Material not available for study ; description and measurements based on David, 1958). Body 1.63 mm. long. Head dark. Antennae 5-segmented, $0.47\times$ as long the body ; antennal segment III longer than IV+V taken together and bearing 30-35 secondary rhinaria, IV and V subequal, each with 8-12, 7-10 secondary rhinaria, respectively. Siphunculi pale. Legs dark. Other characters similar to apterae.



Astegopteryx neelgiriensis David. Apterous viviparous female : 295, whole body ; 296, head ; 297, antenna ; 298, ultimate rostral segment ; 299, hind tarsus ; 300, caudal region ; Alate nymph : 301, whole body.

Colour. : Not noted.

Measurements in mm. :

Length		Antenna	Antennal segments		
			III	IV	V
1.96	1.96	0.77	0.43	0.16	0.18

Sexual forms : Not known.

Nymph : (Apterous, early instar). Body 0.82 mm long, with 0.41 mm as maximum width. Forntal horns distinct, closely placed, gradually narrowing towards apex, +0.073 mm long, 0.66× as long as second segment of hind tarsus ; cephalic haris 8-9 in number 0.016-0.020 mm long, up to 0.60× as long as the basal diameter of antennal segment III. Antennae 4-segmented, pale, except apical segment which is dark ; segment I and II each with a hair, up to 0.040 mm long ; segment III with 3 hairs near apex, 0.026-0.030 mm long and base of segment IV with 2 hairs 0.020-0.030 m long ; segment IV distinctly swollen in the middle ; processus terminalis hardly 0.50× as long as base of last antennal segment. Rostrum reaches hind coxae, ultimate rostral segment dusky, 0.66× as long as second segment of hind tarsus, without any accessory hairs. Abdominal dorsum pale ; hairs on the dorsum of abdomen 4 per tergite (0.020-0.023 mm), placed spino-pleurally, beside a much longer marginal hair on each side (0.060-0.070 mm), these being 0.70×, and 210× as long as the basal diameter of antennal segment III, respectively ; 8th tergite with 2 hairs, up to 0.053 mm long. Wax glands absent, but 2-3 cells in a row can be evident on lateral margin of 5th-6th tergite and on 8th tergite. Legs pale ; hairs on tibiae fine, on outer margin of hind tibiae upto 0.050 mm long, 1.5× as long as the width at the middle of hind tibia ; first tarsal segments with 2, 2, 2 hairs ; dorso-apical hairs on second tarsal segment expanded at apices, those of hind tarsus 0.083 mm long.

Colour : Pale in life.

Measurements in mm. :

Length	Width	Antenna
0.82	0.41	0.26

Antennal segments				urs	ht ₂
I	II	III	IV		
0.03	0.09	0.10	(0.01+0.03)	0.066	0.010

(ex *Bambusa* sp., Coonoor, 18.iv.1953, SKD/ZSI).

Nymph (Alate : late instar) : Body 1.65 mm long, pale, frontal horns, pale, slender, finger-like, 0.090 mm long, nearly equal to the second segment of hind tarsus. Hairs on dorsum of head sparse +0.03 mm long 0.20× as long as basal diameter of antennal segment III. Antennae 5-segmented, 0.35× as long as the body ; segment I, II much broader than long, segment III very thick ; hairs on flagellum sparse, longest one on segment III 0.023 mm long, 0.33× as long as the basal diameter of the segment. Rostrum reaches base of mid-coxae, ultimate rostral segment 0.73× as long as second segment of hind tarsus. Abdominal dorsum pale. Wax glands absent. Siphunculi with large pori, surrounded by a few hair. Legs pale.

Colour : Not known.

Measurements in mm. :

Length		Width	Antenna	
1.65		0.75	0.61	
Antennal segments			urs.	ht
III	IV	V		
0.23	0.11	0.15	0.073	0.100

(ex Bamboo, Coonoor, 18.iv.1953, SKD/ZSI).

Material examined : Two apterae viviparae, one apterous nymph and one alate nymph from *Bambusa* sp. Coonoor, South India, 18.iv.1953, coll. & det. S. K. David, deposited in ZSI collections.

Discussion : The species appears to be endemic to Nilgiri Hills in South India. Infestation has been reported from January to April and in September. Absence of wax glands in adults, pale colour, and pruinose character helps to separate out the species from other related species.

Distribution : India : Nilgiri Hills.

Types : Appears to be in the collections of Dr. S. K. David, Madras. No data for the type series can be evident from the original description of the species provided by S. K. David (1958).

Genus 18. *Cerataphis* Lichtenstein, 19882

1882. *Cerataphis* Lichtenstein, J., *Annis. Soc. ent. Fr.*, (6) : 2 : Lxxv. ; Baker, A.C., 1920. *Bull. U.S. Dep. Agric.*, 826 : 87 ; Hille Ris Lambers, D., 1953. *Agric. J. Fiji.*, 24 (324) : 2 ; Eastop, V.F. 1966. *Aust. J. Zool.*, 14 : 531 ; Raychaudhuri, D.N., Ghosh, M.R., Pal, P.K. & Ghosh, A.K., 1980. In *Aphids of North East India and Bhutan*, 365. Type species : *Coccus lataniae* Boisduval.
1897. *Asterolecanium* Westwood, J.O. *Gardener's chronicle* 3 (12) : 797. Type species : *Asterolecanium orchidearum* Westwood.
1868. *Boisduvallia* Signoret, A. *Annis. Soc. ent. Fr.*, (4) : 8 : 400. Type species : *Coccus lataniae* Boisduval.

Morphology : Body 1.2-2.1 mm long. Apteræ usually dark, flattened, aledrodiform ; head may be fused only with prothorax or with entire thorax, abdominal segments 1-7 fused, segment 8 free. Body in apteræ crenulated with single row of wax glands on the margin up to 7th tergite and similar ones over the entire width of 8th tergite ; frons with a pair of pointed horns, usually arising in close proximity from bulbous bases. Alatae without crenulations or horns but sometimes in alate nymphs, horns and wax glands may be present (e. g. *bambusifoliae* Takahashi). Eyes in apteræ of 3 facets, normal in alatae. Antennae normally 5-segmented, sometimes 4-segmented in apteræ, hardly one third the length of the body ; secondary rhinaria in alatae annular, present on all flagellar segments ; primary rhinaria round, finely ciliated ; processus terminalis very short ; hairs on flagellum fine, sparse and short. Rostrum hardly reaches midcoxae ; ultimate

rostral short, blunt, without accessory hair. Dorsal hairs normally fine, but in apterae one three pair of cephalic hairs often spine-like, with conspicuous tuberculate bases. Dorsum in apterae often dark and rugose. Abdomen with only 6 pair of spiracles, those on 1st being absent. 8th abdominal tergite with 4-10 hairs. Siphunculi ring-like surrounded by few hairs. Cauda slightly constructed at base, more rounded in alatae gallicola, with 4-17 hairs. Subanal plate weakly or distinctly bilobed in normal alatae, with 12-16 hairs on each lobe ; in gallicolae with 61-0 hairs on each side. Subgenital plate with 6-8 hairs on anterior half and 12-14 hairs on posterior margin but in alate gallicolae with 3-5 hairs on anterior part and 11-16 on posterior margin. Legs short, smooth in apterae, trochanters often fused with femora ; first tarsal segments with 4, 4, 2 ; 4, 3, 2 or 3, 3, 2 hairs (*bambusifoliae*) ; dorso-apical hairs on second tarsal segments and ampodial hairs long, funnel-shaped at apices. Forewings with media once branched ; hind wings with both obliques, sometimes wings infuscated along veins (*bambusifoliae*).

First instar nymph of apterae of *lataniae*, Takahashi has been described by Takahaashi (1924) as follows :

Body flat with distinct wax glands, head fused with prothorax and with a pair of long bristles which are longer than horns ; stout, as long as antennal segment I ; antennae 4-segmented ; rostrum reaches hind coxae ; abdominal segments defined, with paired marginal hairs on each side, siphunculi not discernible ; cauda not distinct ; subanal plate entire ; Legs Long, tarsi with a few very long hairs.

Discussion : Signoret (1862) described a genus *Boisduvalia* under Aleyrodidae, with *Coccus lataniae* as type ; the genus was later considered under Coccidae but being preoccupied by a genus in Diptera, the name was not available (Baker, 1920). As such, the generic name *Cerataphis* proposed by Lichtenstein (1888) has been accepted and used by all subsequent authors. A total of 12 species have been listed by Eastop and Hille Ris Lambers (1976) under this genus, of which seven are considered as valid species viz., *bambusifoliae* Tak., 1925, *formosana* Tak., 1924, *fransseni* (H.R.L.) 1933), *freycinetiae* v.d. Goot, 1917, *lataniae* (Boisduval,

1867), *orchidearum* (Westwood, 1879), *palmae* (Ghesquiere, 1934). Hille Ris Lambers (1955) referred to last three of these species as economically important species, infesting orchids and Palms in tropical countries and hot houses in Europe and North America. It is acknowledged that the members of this genus are easily recognisable but due to extreme variability of aleyrodiform apterae, the separation of species becomes difficult (Hille Ris Lambers, 1955, Eastop, 1966 ; Ghosh, M.R. *et al.* 1974). It may be added that Ghosh, M.R. *et al.* (1974) erroneously mentioned that in Malayan *lataniae* described by Takahashi (1950) F.T.C. is 4, 3, 2 but Takahashi stated that it has 4 hairs on fore-anal mid-tarsi and 2 on hind-tarsi.

Biology : The members of this genus normally infest bamboo (*Arundinaria*), orchids (*Calanthe*, *Cymbidium*, *Cyperidium*, *Dendrobium*, *Liparis*, *Vanda*), and palms (*Ancistrophyllum*, *Arcea catechu*, *Coccothraupis nultifera*, *Kentia*, *Latania*, *Metroxylon*, *Nipa*, *Phoenix*, *Raphia*). Eastop (1966) mentioned that sometimes large samples of *C. palmae* (= *variadalis*) have been recorded from *Aloe*, *Cacao*, citrus and figs, indicating extreme polyphagism of some species. All the species were earlier regarded as anholocyclic and monoecious till Hille Ris Lambers (1953) showed that *Styrax* may serve as the primary host for *Cerataphis fransseni* (H.R.L.) alatae of which was earlier described from galls of *Styrax* as *Astegopteryx fransseni* H.R.L. ; these alatae produced typical *Cerataphis* larvae while alatae of other *Cerataphis* spp. exhibited two types of embryos, one of typical type for the genus and the other resembling embryos of *Astegopteryx*. This observation indicates about possible existence of heterocyclic cycle at least in some species of *Cerataphis*. Most of the species have been recorded during March-May and again in October-November ; Takahashi (1950) recorded alate gallicola of *C. fransseni* from *Styrax denzoin* in Malayasia during June-August, producing a single gall at the apex of a branch. Takahashi (po. cit) mentioned that ant of genus *Ceramogaster* sometimes protects and shelters *C. lataniae* in Malayasia.

Distribution : India ; Sri Lanka ; Cambodia ; Malayasia ; Formosa ; Indonesia ; possibly introduced to Australia, Africa, Europe, North America, South America.

Type-species : *Cocos lataniae* Boisduval, 1967. Location of types not known.

Key to the species of *Cerataphis* Lichtenstein

Apterous viviparous female :

1. Frons with a pair of horns. Ventral hairs on frons fine, normal, arising from small sockets. Cauda with 10 or more hairs .. .2

Frons with or without a pair of horns. Ventral hairs mixed with 1-3 short spine-like dagger-shaped or club-shaped hairs near antennal bases, besides normal hairs, and often a pair of spine-like hairs arise from tuberculate bases. F.T.C. 4, 3, 2. Cauda with 5-7 hairs .*C. palmae* (Ghesquiere)

2. Hairs short and blunt, those around siphunculi not much longer than the basal sockets. Longest hair on 8th tergite, distinctly shorter than the longest hair on Cauda. Ultimate rostral segment $0.65-0.75 \times$ as long as second segment of hind tarsus. On Palmaceae .*C. lataniae* (Boisduval)

Hairs long and fine, those around siphunculi distinctly longer than basal socket. Longest hair on cauda. 8th tergite equal to or nearly so, to the longest hair on cauda. Ultimate rostral segment nearly equal to second segment of hind tarsus. On Orchidaceae. .*C. orchidearum* (Westwood)

Alate viviparous female : [material not available; key based on Eastop, 1966].

1. Cauda with ± 14 hairs. Antennal segment III, $3.0-3.5 \times$ as long as ultimate rostral segment which is 0.080-0.095 mm long and nearly equal to second segment of hind tarsus. On Orchidaceae .*C. orchidearum* (Westwood)

Cauda with 4-12 hairs. Antennal segment III $5.0-8.0 \times$ as long as ultimate rostral segment which is 0.050-0.070 mm long and $0.46-0.80 \times$ as long as second segment of hind tarsus. On Palmaceae. 2

2. Cauda with 4-8 hairs. Longest hair near siphunculi 0.015-0.030 mm long. Hind tibiae up to $1.40\times$ as long as antennal segment III. . *C. palmae* (Ghesquiere)

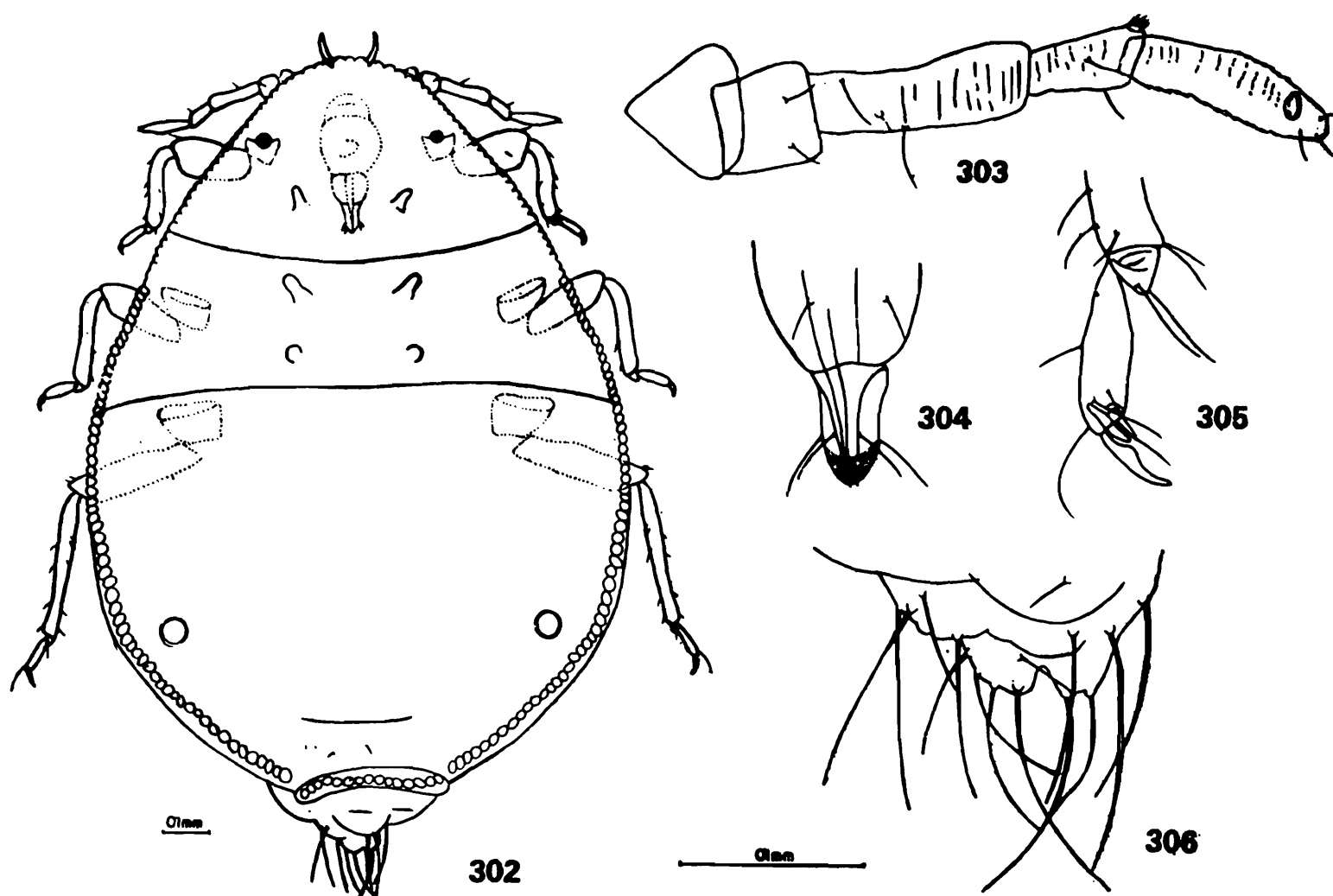
Cauda with 10-12 hairs. Longest hair near siphunculi 0.010-0.015 mm long. Hind tibiae up to $1.10\times$ as long as antennal segment III. . *C. lataniae* (Boisduval)

46. *Cerataphis lataniae* (Boisduval)
(Figs. 302-308)

1967. *Cocous lataniae* Boisduval, J.A., *Essai Ent. hort.*, Paris, 355.

1908. *Aphis palmae* Baehr. W.B. *Zool. Anz.*, 33 : 507-517.

Apterous viviparous female : Body 1.20-1.42 mm long, ovoid, pale brown, with 0.82-1.05 mm as maximum width. Head and thorax usually fused ; dorsum of cephalothorax appears stippled, hairs on dorsum short, spatulate at apices ; venter with a pair of long pointed horns on frons and long fine hairs. Cephalothorax and entire abdomen with crenulate margin formed of wax gland cells, which increase in size posteriorly. Antennae 4-segmented, concolourous with the body, about $0.14-0.15\times$ as long as the body ; segment I with 1, segment II with 2, segment III with 2 fine hairs ; segment IV with spinulose imbrications, bearing one hair near base & processus terminalis $0.21-0.29\times$ as long as the base of last segment. Rostrum short, ultimate rostral segment $0.70-0.30\times$ as long as second segment of hind tarsus. Abdominal segments 1st-7th fused and bearing numerous wax pores ; hairs on dorsum of abdomen short, with slightly expanded apices, longest one upto $0.60\times$ as long as the basal diameter of antennal segment III ; number of hairs on abdominal dorsum variable but arranged characteristically as follows : on segments 1st-5th spinal—one pair, pleural—two pair, marginal—one pair, making a total of 8 hairs per segment ; on 6th segment ; spinal—one pair, pleural—one pair, marginal—one pair, making a total of 6 hairs ; on 7th segment ; spinal—one pair and marginal—one pair, making a total of 4 hairs ; 8th tergite usually with 15-16 elongated, oval wax gland cells and two hairs, which are about $0.60-0.80\times$ as long as the basal diameter of antennal segment III. Siphunculi on elevatea cones, often surrounded by a few short and blunt hairs. Cauda with a basal constriction and bearing long hairs of which the inner



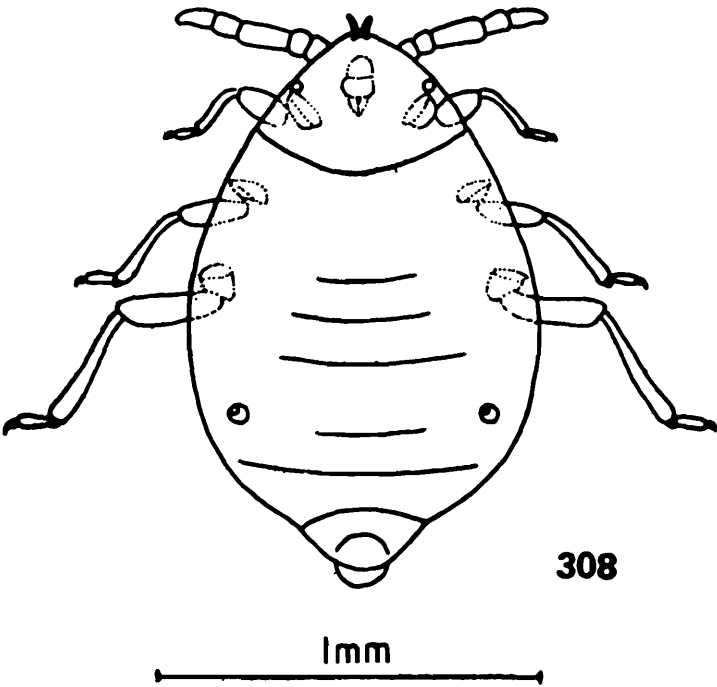
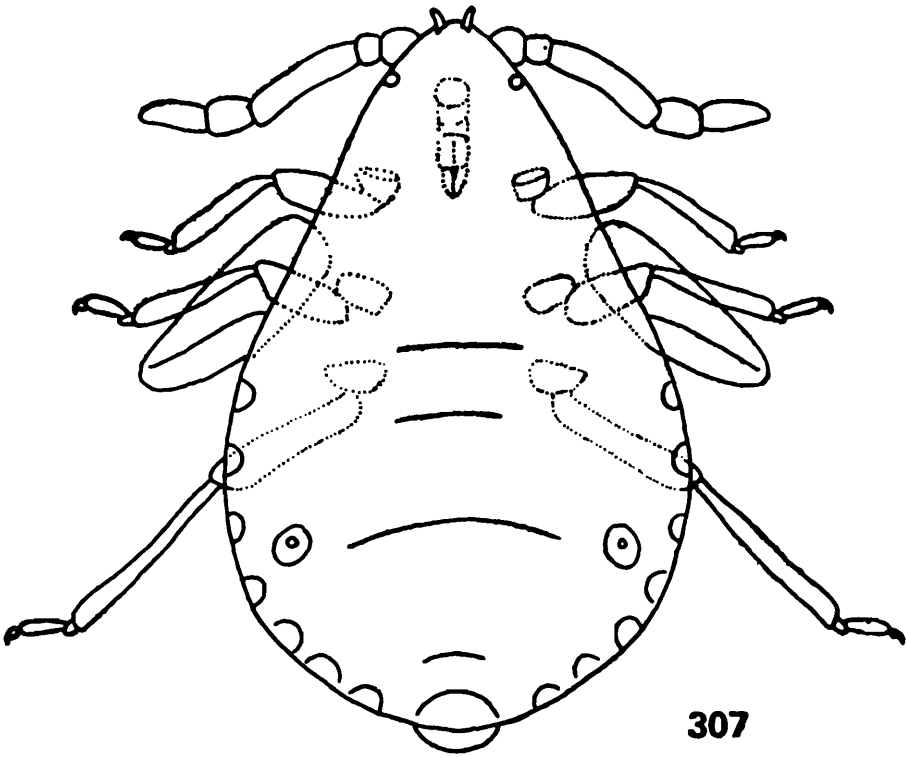
Cerataphis lataniae (Boisduval). Apterous viviparous female : 302, whole body ; 303, antenna ; 304, ultimate rostral segment ; 305, hind tarsus ; 306, caudal region ;

pair appears stouter and longer than others. Legs with femora and tibiae smooth ; first tarsal segments with 4, 3, 2 hairs ; empodial hairs thickened at apices.

Colour : Brown in colour.

Measurements in mm. :

	Length	Width	Antenna
1.	1.30	0.94	0.18
2.	1.32	0.96	0.19



1mm

Alate nymph : 307, whole body. Apterous nymph : 308, whole body.

Antennal segments III	Antennal segments IV	urs	ht ₂	Siph.
0.06	(0.042+0.011).	0.044	0.55	0.02
0.06	(0.040+0.011)	0.045	0.56	0.02

(ex 1, 2, from *Poa* sp., Bhalukpong, Arunachal Pradesh, 31.11.1969, C.U, Colls.).

Alate viviparous female : Not available. According to Palmer (1952), body length 1.4 mm ; Antenna 0.60-0.85 mm long ; antennal segment III 0.32-0.37 mm bearing 23-30 secondary rhinaria, IV 0.14-0.17 mm with 10-12 similar rhinaria and V (0.08-0.05 mm 0.10+0.02 mm) with 7 rhinaria. Second segment of hind tarsi 0.09 mm. Media of forewing once branched.

Sexual forms : Not known.

Material examined : Six apterous viviparous females from *Poa* sp., Bhalukpong, Kameng district, Arunachal Pradesh, 31.11. 1969, coll. H. Banerjee (Calcutta University collection).

Discussion : The species infests undersurface of leaves of host plants. Eastop (1966) mentioned *Latania* sp., *Cocos nucifera* and perhaps other palms as hosts of this species. M. R. Ghosh *et al.* (1974) recorded that according to Eastop (op. cit), the first tarsal chaetotaxy should be 4, 4, 2 but in *palmae* (= *variabilis*) examined during present study as also in the material of *lataniae*, first tarsal chaetotaxy is 4, 3, 2 and as such tarsal chaetotaxy can be regarded as a variable character in this group. Hills Ris Lambers (1953) and Eastop (1966) did not mention of its occurrence on any other than in Palmaceae and present record in *Poa* appears to be an exception.

Distribution : India ; Malayasia ; Java ; New Southwales; England; U.S.A.

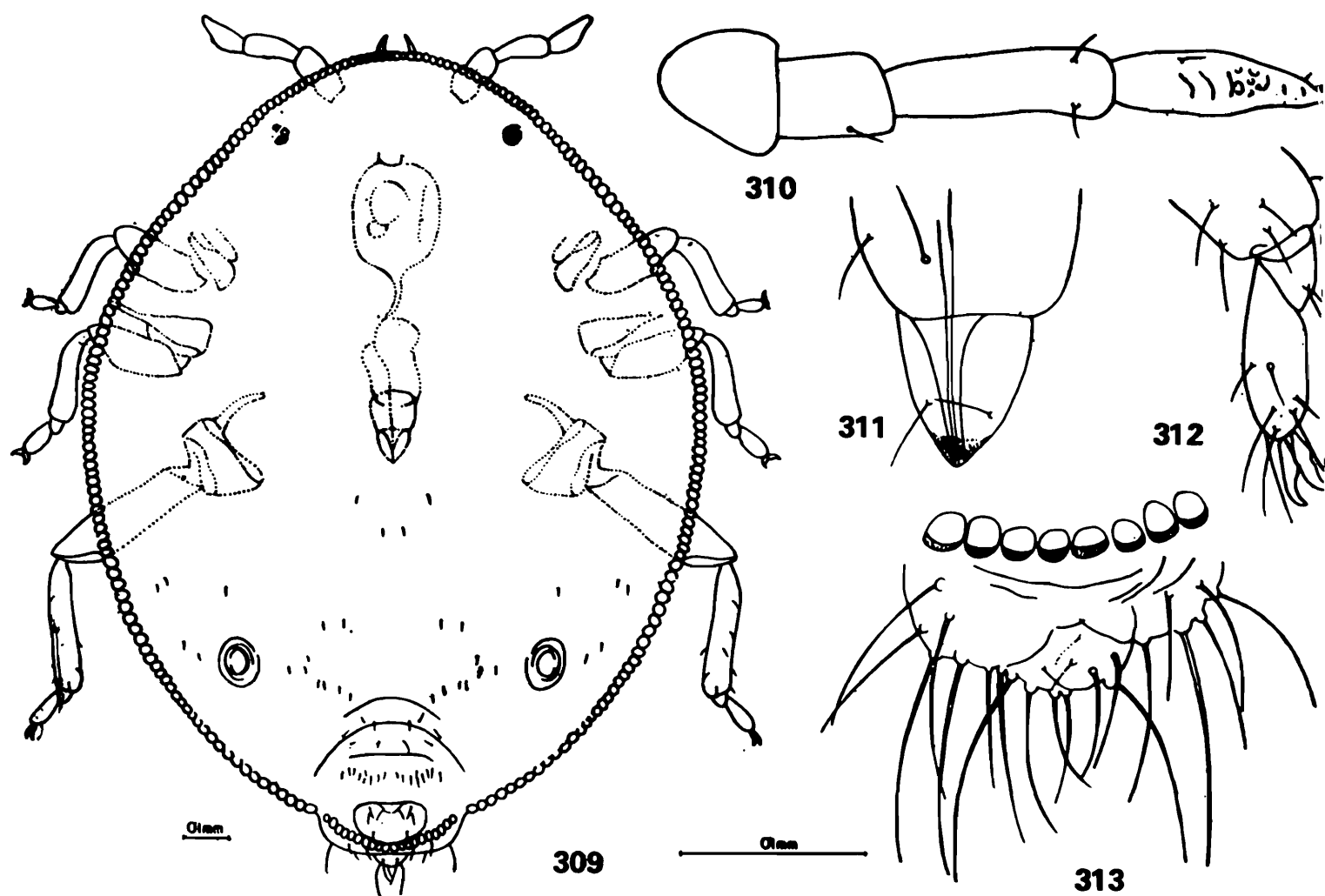
Types : Location of types not known.

47. *Cerataphis orchidearum* (Westwood)
(Figs. 309-313)

1979. *Asterolecanium orchidearum* Westwood, J. O., *Gdnr's chron*, 1879 ; 706.
 1948. *Cerataphis lataniae* (misid.), Zimmerman, E.C., *Insects of Hawaii*, 5 : 127
 1953. *Cerataphis orchidearum*, Hille Ris Lambers, D., *Agric.J.Fiji*, 24 : 4.
 1966. *Cerataphis orchidearum*, Eastop, V.F., *Aust. J. zool.*, 14 : 533.
 1969. *Cerataphis orchidearum*, Basu, A.N., *Oriental Ins.*, 3 (4) : 357.
 1980. *Cerataphis orchidiurum*, Heie, Ole, E., *Fauna ent. scand.*, 9 : 88.

Apterous viviparous female : Body flat, circular, 1.38-1.44 mm long with 0.96-1.14 mm as maximum width. Head fused with thorax ; cephalthorax with a pair of sharply pointed ventral horn like processi on frons, which are united at base ; hairs fine, 0.026-0.040 mm long, $2.0-3.0\times$ as long as the diameter at constricted base of antennal segment III. Antennae ((4-5) segmented, $0.15-0.17\times$ as long as the body ; segment I broader than long with 2-3 short hairs, segment II with 2 hairs ; flagellum with spinulose imbrications ; segment III without any hair, segment IV and V with one hair each ; hairs on II and IV 0.020-0.026 mm long, $1.0-1.3\times$ as long as the basal diameter of antennal segment III ; hair on base of segment V up to 0.013 mm long, $0.66\times$ as long as the mentioned diameter ; processus terminalis slender, $0.33\times$ as as the bulbous base. Rostrum stout reaching near the base of hind coxae ; ultimate rostral segment broadly triangular, nearly equal to second segment of hind tarsus and bears only long preapical hairs. Abdominal dorsum yellow, hairs on the dorsum of abdomen 0.010-0.016 mm long, upto $0.70\times$ as long as the basal diameter of antennal segment III ; spinal hairs on 8th tergite 0.030-0.033 mm long and upto $1.8-2.0\times$ as long as the mentioned diameter. Siphunculi with large pori, surrounded by 3-4 small hairs around the rim. Cauda with 9-10 long hairs. Subanal plate bilobed, each lobe with 7-8 long hairs. Subgenital plate with 7-8 hairs on anterior half and 15 hairs on posterior margin. Legs with femora and trochanters fused ; tibiae and tarsi smooth ; hairs on tibiae 0.023-0.033 mm long, $0.50-0.70\times$ as long as the diameter at the middle of tibiae ; first tarsal segments with 4, 4, 2 hairs ; dorso-apical hairs on second tarsal segments up to 0.040 mm long, flattened at apices, much longer than the claws ; empodial hairs fine.

Colour : Dark reddish brown to black with a waxy fringe.



Cerataphis orchidearum (Westwood). Apterous viviparous female : 309, whole body ; 310 antenna ; 311, ultimate rostral segment ; 312, hind tarsus ; 313, caudal region.

Measurements in mm. :

	Length	Width	Antenna
1.	1.38	1.10	0.28
2.	1.34	0.96	0.29
3.	1.58	1.24	0.30

III	Antennal segments		urs	h ₂	Siph. diam.
	IV	V			
0.07	0.046	(0.05+0.04)	0.07	0.07	0.04
0.08	0.046	(0.05+0.04)	0.07	0.07	0.04
0.07	0.050	(0.05+0.04)	0.07	0.06	0.04

(1, 2, 3, ex *Epidendron* sp., Ootacamund, 3.xii.1963, ZSI).

Alate viviparous female : Not available for present study ; description from Heie, 1980).

Frons without horns. Antennae 5-segmented about $0.40\times$ as long as body ; segment III about as long as segments IV+V taken together or little longer, with about 20 secondary annular rhinaria ; segments IV and V each with about 10 such rhinaria. Legs longer than in apterae. Siphuncular pores present. Cauda with about 10 hairs. Forewings with media once branched, hind wings with both obliques.

Sexual forms : Not known.

Material examined : Four apterous viviparous females from *Epidendron* sp., Ootacamund, India, 3.xii.1965, Coll, S. K. David (ZSI).

Discussion : The species has been recorded from *Cymbidium mastersii*, *Dendrobium gracilicorne*, *Cyperidium* sp., *Calathe volkensii*, *Liparis* sp. and *Vanda tricolor* (Eastop, 1966). Hille Ris Lambers (1953) mentioned that often this species is recorded in tropical countries and hot houses in North America and Europe under the name of *C. lataniae*. Heie (1980) mentioned that it has probably originated in Asia and secondarily introduced elsewhere. The species lives an anholocyclic life-cycle on Orchidaceae but alatae appear to be rare.

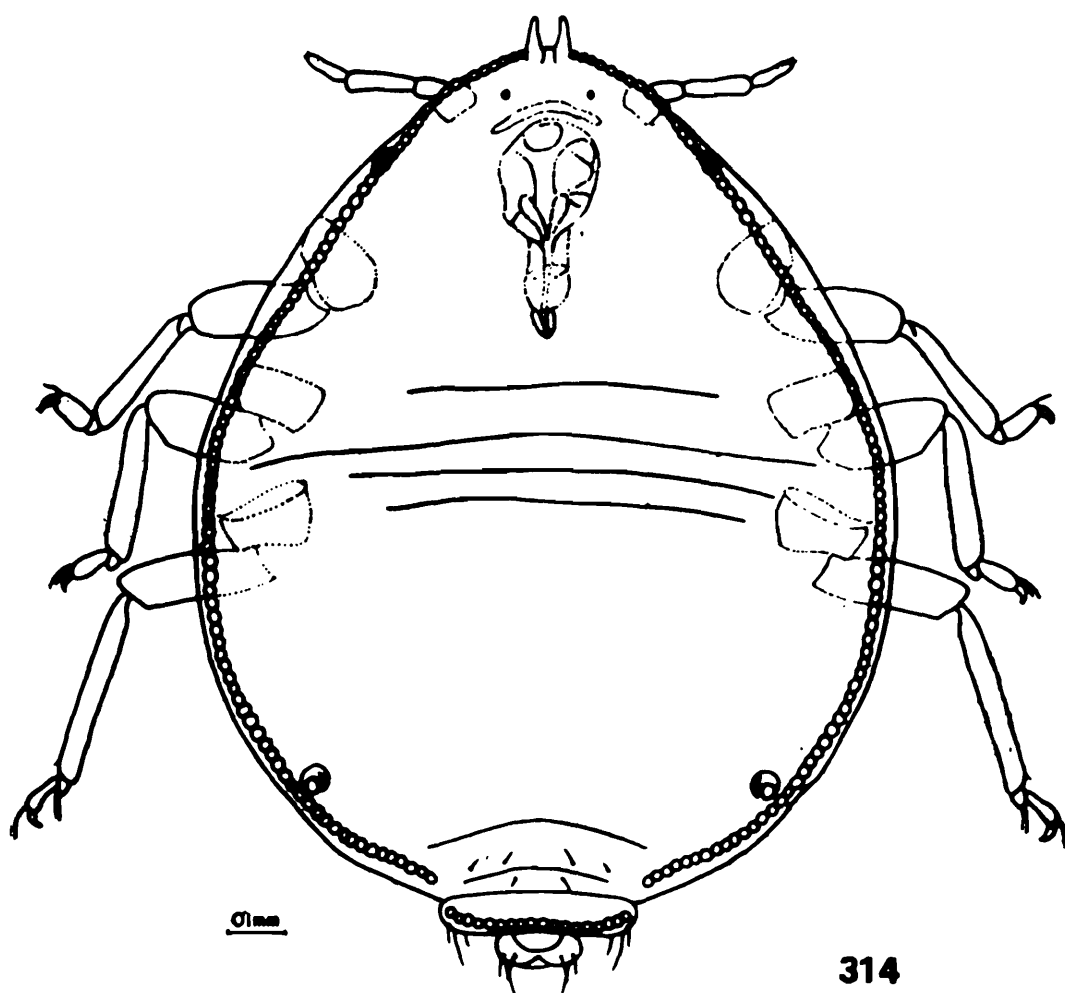
Distribution : India ; Java ; Solomon Island ; Africa ; Fiji ; Queensland, New South Wales ; Europe ; North America ; South America.

Types : Location of types not known.

48. *Cerataphis palmae* (Ghesquiere)
(Figs. 314-318)

1934. *Alcurocanthus palmae* Ghesquiere, J., *Ann. de Geonbloux*, **40** : 34.
 1953. *Cerataphis variabilis* Hille Ris Lambers, D., *Agric. J. Fiji*, **24** : 3.
 1958. *Cerataphis variailis*, David, S. Kunakraj, *Ind. J. Ent.*, **20** (2) : 126.
 1961. *Cerataphis variabilis*, Basu, A.N., *Sci. Cult.*, **27** (9) : 256.
 1963. *Cerataphis variabilis*, Nair, R.B. and Menon, R., *Areca J.*, Kozhikode, **14** (4), 139.
 1980. *Cerataphis variabilis*, Raychaudhuri, D.N., Ghosh, M.R., Pal, P.K. and Ghosh, A.K. *In Aphids of North East India and Bhutan*, 367.

Apterous viviparous female : Body 1.26-1.52 mm long, ovoid dorsoventrally flattened with crenulate margin. Head and thorax often fused, sometimes head fused only with prothorax and separated from fused meso-and meta-thorax. Head with a pair of anteriorly directed pointed horns which are at least twice as long as antennal segment II, in specimens with 4, segmented antennae ; venter of head with a pair of thick dagger-shaped spine-like hairs ; cephalothorax as also abdomen with crenulate margins formed of distinct wax gland cells. Antennae 4-5-segmented, pale brownish, $0.16-0.25\times$ as long as the body, segments I with one, II with 1-2, III with 1-2 and base of IV with 1 fine hair, 0.01-0.02 mm long, and at most $1.4\times$ as long as the basal diameter of segment III ; segment III and IV (when 5-segmented) with fine spinulose imbrications apicad or otherwise segments IV (when 4-segmented) or V (when 5-segmented) with more distinct imbrications ; processus terminalis $0.40-0.50\times$ as long as the base of last antennal segment. Rostrum short and stout, ultimate rostral segment $0.75-0.80\times$ as long as the second segment of hind tarsus with 2 pair of preapical hairs. Abdominal segments 1st-7th fused and free of 8th segment ; dorsum with scattered wax pores and entire margin crenulated as in cephalothorax ; hairs on dorsum fine, usually 6-8 per segment, equal to or little longer than the basal diameter of antennal segment III ; 8th tergite with 14-16 round to oval wax gland cells along the crenulate margin. Siphunculi on elevated cones surrounded by 3-6 hairs. Cauda slightly constricted at base and bearing 4-6 hairs. Subanal plate indented. Legs with trochanters fused with femora, pale brown ; tibiae and tarsi smooth ; first tarsal segments with 4, 3, 2 hairs. Empodial hairs slightly thickened.



Cerataphis palmae (Ghesquire). Apterous viviparous female : 314, whole body.

Colour : Brown to dark brown in life.

Measurements in mm. :

	Length	Width	Antenna
1.	1.26	0.85	0.23
2.	1.43	1.03	0.24
3.	1.28	0.88	0.22
4.	1.38	0.96	0.24
5.	1.38	0.03	0.29
6.	1.52	1.14	0.31

Antennal segments					Frontal horns	urs	ht ₂	Siph. diam
I	II	III	IV	V				
0.04	0.03	0.09	(0.05+0.02)	—	0.07	0.05	0.07	0.03
0.04	0.03	0.09	(0.05+0.02)	—	0.07	0.05	0.07	0.03
0.04	0.04	0.09	(0.05+0.02)	—	0.07	0.05	0.07	0.03
0.04	0.04	0.10	(0.05+0.01)	—	0.07	0.05	0.07	0.03
0.05	0.05	0.11	(0.05+0.03)	—	0.07	0.05	0.07	0.03
0.04	0.05	0.05	0.05	(0.07 +0.03)	0.05	0.06	0.08	0.03

(Nos. 1, 2, 3 Hille Ris Lambers Collection, Nos. 4, 5, 6 C.I.B.C. colls.).

Alate viviparous female : Head and thorax brownish, separate ; head without any frontal horns ; venter with 1-2 pair of spine-like hairs. Antennae brownish, 5-segmented, 0.04-0.42× as long as the body ; flagellum gradually more distinctly imbricated apicad, with hardly any conspicuous hair ; segment III with 26-30, IV with 10-11 and base of V with 6 annular rhinaria distributed over entire lengths ; processus terminalis 0.15-0.16× as long as base of segment V Abdominal dorsum pale ; dorsal hairs fine. Legs pale brownish, femora and trochanters fused ; first tarsal segments with 4, 3, 2 hairs, lateral ones 0.03-0.04 mm long, Wings pale, media of forewings arising some distance away from subcosta, once branched ; Cubitus and anal united at base ; hind wings with 2 obliques. Cauda broader than long and bearing 6 hairs.

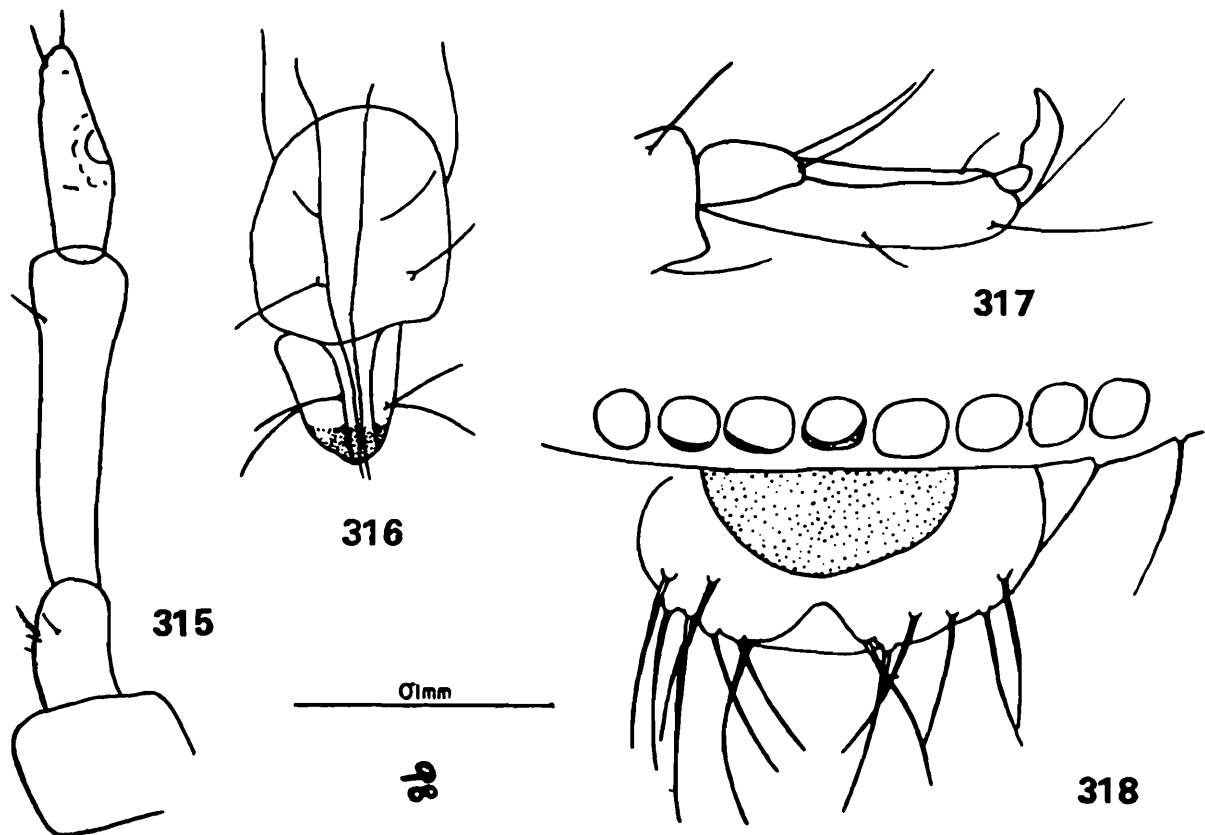
Colour : Not known.

Measurements in mm. :

	Length	Width	Antenna
1.	1.67	0.75	0.69
2.	1.72	0.82	0.73

Antennal segments			urs	ht ₂	Siph. diam.	Cauda
III	IV	V				
0.38	0.14	(0.09+0.02)	0.07	0.08	0.04	0.03
0.38	0.14	(0.09+0.02)	0.06	0.08	0.04	0.03

(1, 2 ex *Areca catechu*, Hosur, Bangalore, 26.vi.1962, CIBC).



Apterous Viviparous female :
315, antenna ; 316, ultimate rostral segment ; 317, hind tarsus ; 318, caudal region.

Sexual forms : Not known.

Embryos & larvae : Not known.

Material examined.: Three apterous viviparous females, from *Cocos Nucifera*, Guadal canal, British Solomon Island, 12.v.1950, leg. B.A. O'Connor, det D.H.R.L. ; 13 apterous viviparous female, from *Calamus rotanc*, Coimbatore, Tamil Nadu, India, 20.vi.1954, leg. S. K. David, det. S. K. David ; 2 apterous viviparous females

and 4 alate viviparous females from *Areca catechu*, Hosur, Bangalore, Mysore, India, 26.vi.1968, leg. C.I.B.C., det D.H.T.L.

Discussion : In India, so far this species has been recorded from *Areca catechu* in West Bengal and South India, and from *Calamus rotang*, and *Cocos nucifera* in South India. Eastop (1966) mentions that host plants may also include plants of Cyclanthaceae, Rutaceae and Liliaceae besides Palmae. It has been pointed out by Eastop (op. cit) that most records of *Cerataphis bataniae* prior to 1953, appear to apply to this species. According to David (1958) this aphid was noted by Lefory (1909) on seedlings of Palm imported to India from Sri Lanka. The dagger-shaped hairs of apterae appear to be the chief distinguishing feature of this species but enormous variability of apterae is well known (H. R. L., 1963).

The available records indicate that this species infests lower surface of fronds of *Cocos nucifera* in February and again in September and is not attended by ants on that plant (David, 1958). It infests stem of terminal shoot of *Calamus rotang* throughout the year and sometimes in large numbers and alates are produced in June and July (David, 1958) ; on *Areca catechu*, this species infests in large number the inflorescence, pathae and pinniae during May—June and on the last two host plants they are often attended by ants, during rainy season.

Distribution : India : West Bengal, Tamil Nadu, Karnataka, Kerala ; Sri Lanka ; Thailand ; Malayasia ; Papua ; Solomon Island ; Fiji ; Tropical Africa ; British Guiana ; Colombia ; Dominica ; Puerto Rico ; Jamaica ; Trinidad.

Types : Location of types of *palmae* not known. Types of *variabilis* deposited in D. Hille Ris Lambers' Collections, Bennekom, The Netherlands.

Ganus 19. *Ceratoglyphina* van der Goot, 1917

1917. *Ceratoglyphina* van der Goot, P., *Contrib Fauna Indees Neerl.* 3 : 237 ; Baker, A.C., 1921. *Bull. U.S. Dep. Agric.*, 826 : 85 ; Takahashi, R., 1931. *Aphididae of Formosa*, 6 : 100 ; Ghosh, M.R., Pal, P.K. & Raychaudhuri, D.N., 1976. *Proc. zool. Soc. Calcutta*, 27 : 93 ; Raychaudhuri, D.N., Ghosh, M.R., Pal, P.K. & Ghosh, A.L., 1980. *In Aphids of North East India and Bhutan*, 367. Type species : *Ceratoglyphina bambusae* van der Goot

Morphology : Body oval. In apterae, head fused with prothorax and bears a pair of long rather pointed frontal horns, these being much reduced in alatae. Antennae 4-5-segmented in apterae, 5-segmented in alatae, short, hardly exceeding $0.25\times$ as long as the body ; flagellum usually spinulose ; secondary rhinaria in alatae subannular, non-ciliated, present on all flagellar segments ; primary rhinaria round and ciliated in apterae, irregular in alatae ; processus terminalis much shorter than half the length of base of last antennal segment. Eyes of 3 facets in apterae, normal in alatae and with small ocular tubercles. Rostrum short, hardly reaching beyond forecoxae ; ultimate rostral segment without accessory hairs. Dorsum in apterae dark with wax pores specially on abdomen, besides marginal groups of wax glands on thoracic and 1st to 7th abdominal tergites. Dorsal hairs long, fine. Siphunculi pore-like, surrounded by hair-bearing sclerotic rims. Cauda semilunar, broad, with many hairs. Subanal plate rounded. First tarsal segments with 4, 3, 2 hairs ; dorso-apical hairs on second tarsal segments with funnel-shaped apices. Forewings with media once branched ; hind wings with two obliques.

Discussion : van der Goot (1917) described the genus with *C. bambusae* n.sp., as type-species infesting bamboo in Java and separated this genus from the related ones by the nature of cauda and subanal plate. Takahashi (1925) described the alate nymph of *bambusae* from Formosa. A subspecies, *bambusae bengalensis* L. K. Ghosh, 1972, has since then been described from North east India, both apterous and alatae of which differ in some characters from the nominate species. No other species is known under this genus.

Biology : The species forms dense colonies on the leaf bases of host plant during March-May in India and Formosa ; it leads

a monoecious anholocyclic life-cycle on Bomboo. Occasionally, attendance by black-ants has been reported. No detail observation on numbers of generations and life-history has been reported.

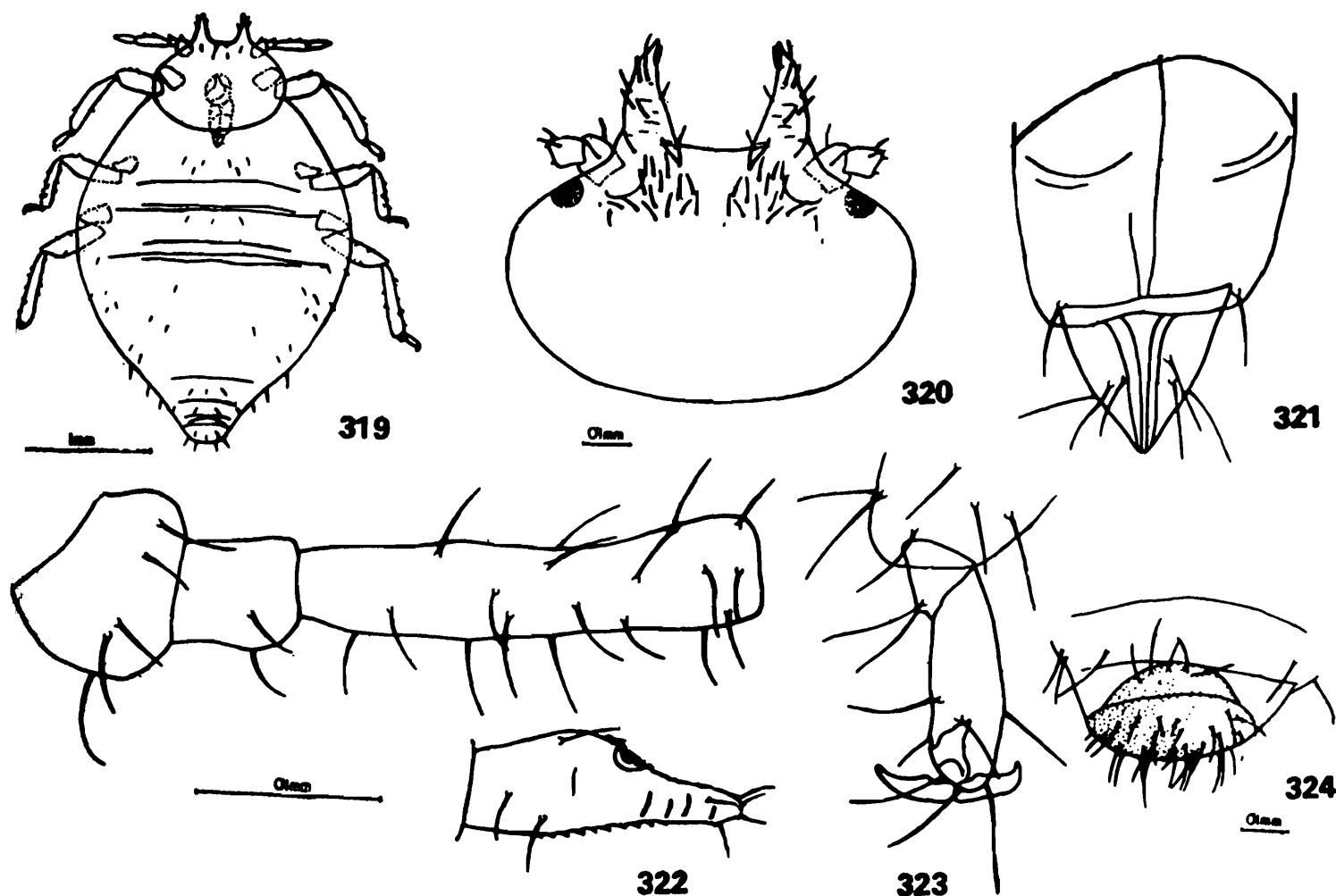
Distribution : India : Assam, Manipur, Sikkim, West Bengal, Himachal Pradesh ; Formosa ; Java.

Type species : *Ceratoglyphina bambusae* van der Goot, 1917 ; location of types not known.

49. *Ceratoglyphina bambusae bengalensis* L. K. Ghosh
(Figs. 319-332)

1972. *Ceratoglyphina bambusae bengalensis* Ghosh, L.K., *Orient. Ins.*, **6** : 301.
1974. *Ceratoglyphina bambusae bengalensis*, Ghosh, M.R., Pal, P.K. & Raychaudhuri, D.N., *Proc. zool. Soc. Calcutta*, **27** : 93.
1980. *Ceratoglyphina bambusae bengalensis*, Raychaudhuri, D.N., Ghosh, M.R., Pal, P.K. & Ghosh, A.K. *In* Aphids of North East India and Bhutan, 368.

Apterous viviparous female : Body oval, 2.16-2.35 mm long with 1.40-1.60 mm as maximum width. Frons flat bearing a pair of frontal horns which are slightly curved inwards, pointed at apices and about $2.5\times$ as long as antennal segment II ; hairs on the frontal horns 8-9, 0.020-0.043 mm (0.050 mm) long, $1.1-1.5\times$ ($2.0\times$) as long as the basal diameter of antennal segment III. Antennae 4-segmented, $0.19-0.22\times$ as long as the body ; segment I with 3-4 hairs, 0.020-0.026 mm long, segment II with 2 hairs of similar length ; segment III with some fine spinular imbrications and bearing 9-11 hairs, 0.026-0.040 mm long, up to $1.5\times$ as long as the basal diameter of the segment ; segment IV with conspicuous spinulose imbrication and bears 2-3 hairs, 0.030-0.040 mm long ; processus terminalis blunt, rounded at apices, $0.60-0.75\times$ as long as base of last antennal segment. Rostrum short, stout, hardly reaching midcoxae, ultimate rostral segment broad, $0.72-0.88\times$ as long as second segment of hind tarsus and without any accessory hairs. Abdominal dorsum dark to yellowish brown, with large quadrangular wax gland areas placed marginally up to 7th tergites ; hairs on the dorsum of abdomen thin, with acute apices, these being 0.033-0.115 mm long, increasingly becoming longer towards caudal end, up to $1.5-4.3\times$ as long as the



Ceratoglyphina bambusae bengalensis L. K. Ghosh, Apterous viviparous female ;
 319, whole body ; 320, head ; 321, ultimate rostral segment ; 322, antenna ;
 323, hind tarsus ; 324, caudal region.

basal diameter of antennal segment III ; 8th tergite with 4-5 long hairs, upto 0.134 mm long and $5.0\times$ as long as the mentioned diameter. Siphunculi cone-like with small pori surrounded by 5-6 fine hairs. Cauda broad, semilunar bearing at least 9-10 hairs. Subanal plate rounded. Subgenital plate normal ; hairs fine, numerous. Legs short stout ; tibiae pubescent ; longest hair on hind tibiae upto 0.040 mm long, $0.60\times$ as long as the diameter at the middle of the tibiae ; first tarsal segments with 4, 3, 2 hairs ; dorso-apical hairs on second tarsal segments expanded at apices.

Colour : Pinkish in life.

Measurements in mm. :

	Length	Width	Antenna	
1.	2.07	1.44	0.40	
2.	2.06	1.42	0.41	
3.	2.16	1.46	0.44	
4.	2.25	1.50	0.44	
	Antennal segments		urs	ht ₂
	III	IV		
	0.019	(0.07+0.04)	0.07	0.09
	0.018	(0.07+0.04)	0.07	0.09
	0.19	(0.07+0.05)	0.07	0.08
	0.21	(0.07+0.05)	0.07	0.08

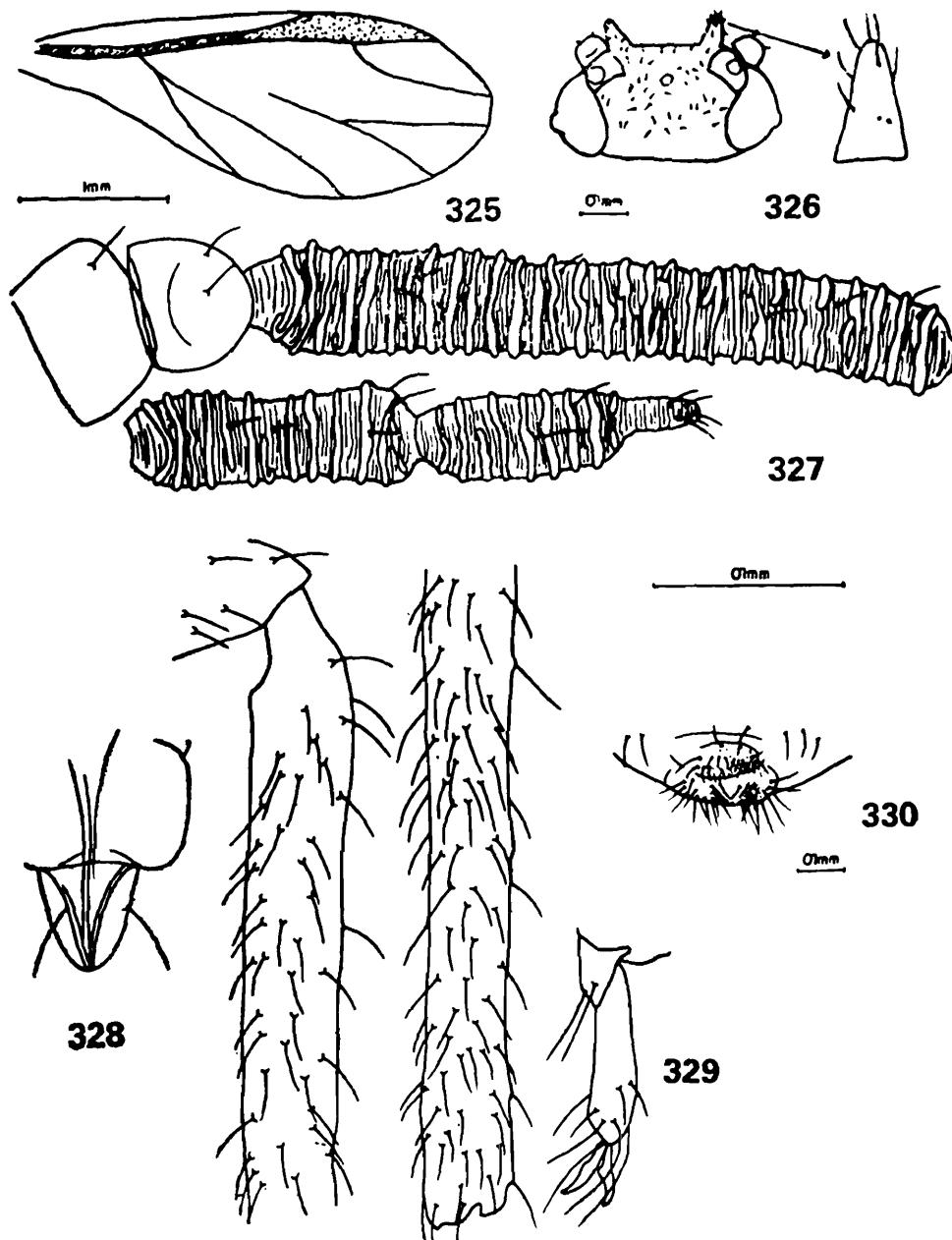
(1, 2 ex Bamboo, Kamsi Forest, Kalimpong, 9.vii.70. C.U.
3, 4 ex Bamboo, Kalimpong, 8.v.1968, Z.S.I.).

Alate viviparous female : Body 1.93-2.46 mm long with 1.39 mm as its maximum width. Frontal horns with blunt apices, $1.4\times$ as long as antennal segment II, bearing 8-10 fine hairs up to 0.03 mm long and $1.4\times$ as long as the basal diameter of antennal segment III. Antennae 5-segmented, $0.33\times$ as long as the body ; flagellum fine, longest one on segment III similar to those on horns ; segment III with 30, IV with 12-13, V with 8-9 secondary rhinaria ; processus terminalis $0.33\times$ as long as base of last antennal segment. Rostrum extends beyond forecoxae, ultimate rostral segment $0.57\times$ as long as second segment of hind tarsus. Thoracic tergites with many wax pores. Abdominal dorsum pale, smooth bearing pale brown marginal sclerites and spinopleural sclerotic area on 8th tergite ; hairs on the dorsum of abdomen fine, longest one on anterior tergites upto $2.6\times$ as long as the basal diameter of antennal segment III ; 8th tergite with 7-8 hairs, longest one being $5.0\times$ as the mentioned diameter. Legs with femora and tibiae smooth ; first tarsal segments with 4, 3, 2 hairs. Wing venation normal, forewings with few long hairs on distal part.

Colour : Not recorded.

Measurements in mm. :

	Length	Width	Antenna
1.	1.93	1.30	0.89
2.	2.46	1.42	0.89



Alate viviparous female : 325, forewing ; 326, head ; 327, antenna ; 328, ultimate rostral segment ; 329, hind leg ; 330, caudal region.

III	Antennal segments		urs	ht ₂
	IV	V		
0.42	0.19	(0.13+0.04)	0.062	0.11
0.41	0.18	(0.12+0.04)	0.065	0.091

(1, ex Bamboo, Kalimpong, 22.iii.1978, coll. A.K.G. ; 2, ex Bamboo, Tashiding, 11.v.1970, coll. M. R. Ghosh, C.U.).

Nymph (Alate) : Body broad, robust. Head with a pair of stout frontal horns, ending in short pointed apices, bearing 10-11 fine hairs. Antennae 5-segmented, segment III with 8-9, IV with 7-9 and base of V with 2 fine hairs ; primary rhinaria small, round. Rostrum reaches midway to mid-coxae ; ultimate rostral segment $0.70\times$ as long as second segment of hind tarsus. Dorsal hairs fine. Wax plates arranged marginally on 1st-7th abdominal tergites, each with one long hair (0.07-0.12 mm) and 2-3 fine hairs (0.03-0.07 mm) ; 8th tergite with 7-8 hairs. Siphunculi on small cones surrounded by 7-8 hairs. Legs with many fine hairs on femora and tibiae.

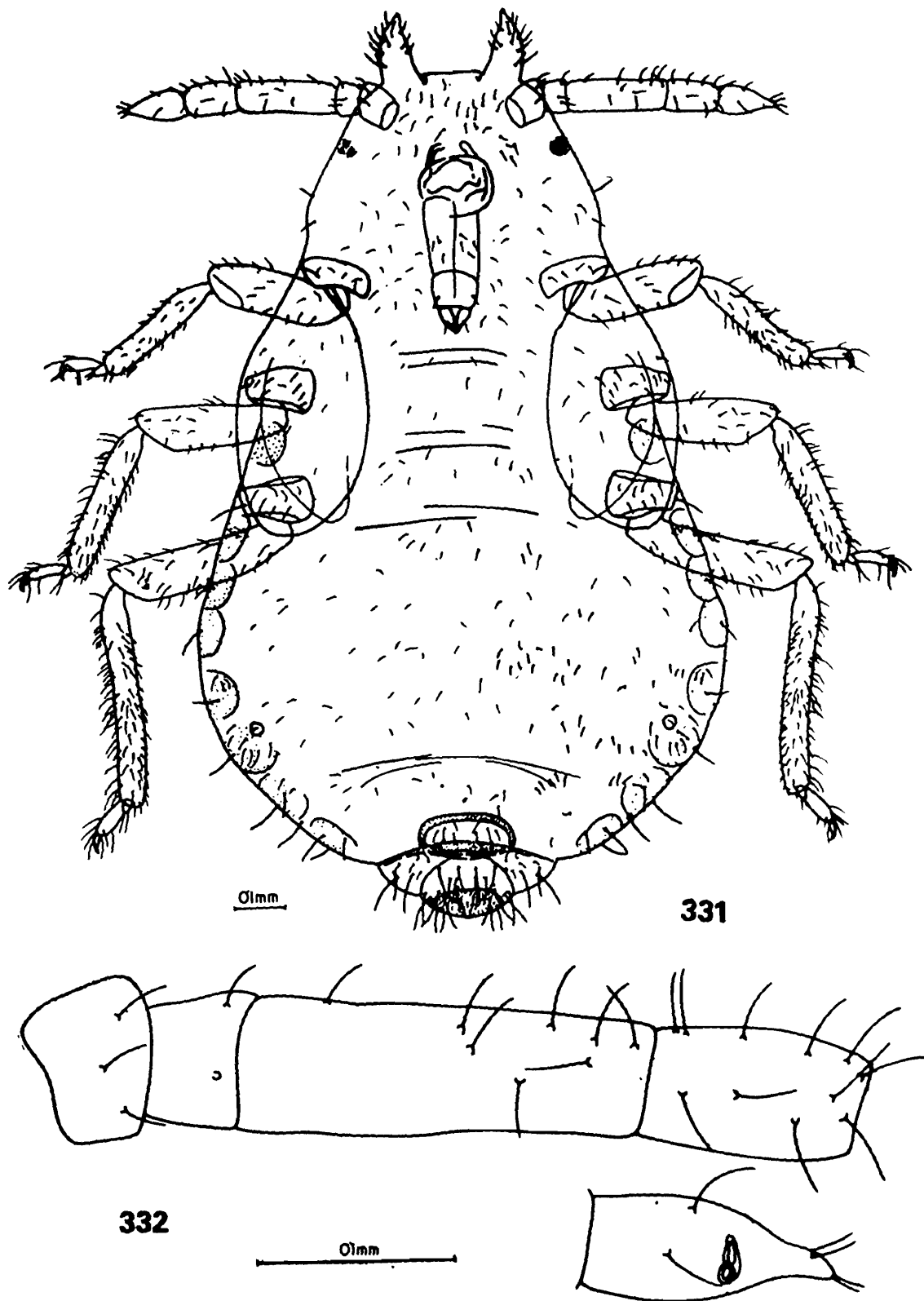
Measurements in mm. :

	Length	Width	Antenna		
1.	1.77	1.13	0.62		
2.	1.77	1.07	0.55		

III	Antennal segments		urs	ht ₂	Frontal horn
	IV	V			
0.22	0.12	(0.08+0.05)	0.07	0.09	0.16
0.19	0.09	(0.08+0.045)	0.07	0.09	0.16

(1, 2 ex Bamboo, Kalimpong, 8.v.1968, Coll. L.K. Ghosh, Z.S.I.).

Material examined : Three apterous viviparous females (Paratypes) and 4 alate nymphs from Bamboo, Kalimpong, Darjeeling District, India, 8.v.1968, Coll. L. K. Ghosh (ZSI) ; Three



Alate nymph : 331, whole body, 332, antenna.

apterous viviparous females from Bamboo, Kalimpong, Darjeeling District, India, 9.vii.1970, coll. M.R. Ghosh (C.U. PLK

2287) ; one alate viviparous female from Bamboo, Kalimpong, Darjeeling District, India, 22.iii.1968, Coll. A. K. Ghosh (C.U.) ; one alate viviparous female from Bamboo, Tashiding, 11.v.1970, Coll. M. R. Ghosh (C.U.).

Discussion : The subspecies differs from nominate species from Java in having longer frontal hairs extending up to 0.050 mm (0.025 mm), antennal segment III being longer than frontal horns and in having pinkish or brown colour in life as against dark colour ; the alatae of subspecies differ from nominate species in having longer frontal horns and more secondary rhinaria on III, IV, V antennal segments. Usually, moderate to heavy infestation on leaf sheaths of apical shoot of hosts plant is recorded. The species is myrmecophilous being often visited by black ants, *Paratrechina bourbonica* (For.). Powdery white waxy secretion may be noted along the margin of body. In hilly region of West Bengal, it has been recorded between altitude of c 600 m-1500 m.

Distribution : India : Assam, Manipur, Sikkim, West Bengal and North West India.

Types : In the National Zoological collections, Zoological Survey of India, Calcutta, India.

Genus 20. *Ceratovacuna* Zehntner, 1897

1897. *Ceratovacuna* Zehntner, L., *Archif. Java. Suikerindust.*, 5 : 553 ; Takahashi, R., 1931. *Rep. Dept. Agric Govt. Res. Inst. Formosa*, 53 : 94 ; Takahashi, R., 1958. *Kontyu*, 26 : 187 ; Eastop, V.F. and Hille Ris Lambers, D., 1976. *Survey of the World's Aphids*, 130 ; Ghosh, M.R., Pal P.K., Raychaudhuri, D.N., 1974. *Proc. zool. Soc. Calcutta*, 27 : 95 ; Raychaudhuri, D.N., Ghosh, M.R., Pal, P.K., Ghosh, A.K., 1980. *In Aphids of Northeast India and Bhutan*, 369. Type species : *Ceratovacuna lanigera* Zehntner.

Morphology : Body oval or elongated oval. Head fused with prothorax in apterae and bearing a pair of frontal horns ; frontal horns distinct in apterae, reduced in alatae ; cephalothorax usually with defined groups of wax gland cells ; hairs on dorsum long and fine or little swollen, Antennae 4-5-segmented in apterae, always

5-segmented in alatae $0.10-0.40\times$ as long as the body ; imbrication on flagellum often spinulose ; hairs on flagellum of variable length ; processus terminalis never more than half the length of base of last segment ; primary rhinaria round, protuberant ; secondary rhinaria in alatae subannular, present on all segments of flagellum. Eyes of 3 facets in apterae. Rostrum short, extending upto mid-coxae, ultimate rostral segment blunt, at least in apterae, shorter than second segment of hind tarsus and without any accessory hairs. Abdominal dorsum pale in apterae but often sclerotic in areas of wax-gland cell groups ; wax gland cells may be arranged in segmental groups on marginal, pleural and spinal region or may be only in marginal or pleural or spinal region or may be absent in anterior segments except on 8th tergite ; 8th tergite with a spino-pleural wax gland cell-groups ; hairs on the dorsum sparse, fine, acute or little swollen at apices. Dorsum of abdomen in alatae with variable spino-pleural sclerotic bands, specially on post siphuncular region. Siphunculi poriform, on coxae, usually with a sclerotic rim and may be surrounded by a few hairs. Cauda constricted at base bearing fine hairs. Subanal plate bilobed. Legs smooth or variably spinulose ; first tarsal segments with variable chaetotaxy viz., 4, 3, 2 ; 3, 3, 2 ; 3, 2, 2 (alatae of *styraci* from galls show 4, 4, 3 hairs), dorso-apical hairs on second tarsal segments expanded at apices. Forewings with media once branched, pterostigma short, hindwings with both obliques.

Nymphs with slender and pointed frontal horns ; head and pronotum defined in fourth instar of alatae viviparae and in adult but fused in other instars of alate and all instars of apterae ; siphunculi are not discernible in first instar ; eyes in all instars of apterae 3-faceted, as also in first three instars of alatae (Takahashi, 1924).

Discussion : Takahashi (1931) pointed out that the genus *Ceratovacuna* has often been considered synonymous with *Oregma* by aphidologists e.g. Baker (1920), van der Goot (1917) and Börner (1930) but can be separated from the latter by the absence of chitinisation. Ghosh, M.R., *et al.* (1974) pointed out that extent or chitinization of the body is rather a variable character and as such cannot be used for separating genera and provided a key for separating *Astegopteryx* (= *Oregma*) and related genera including

Ceratovacuna largely based on nature of dorso-apical hair on 2nd tarsal segment and wax gland cells on 8th tergite and elsewhere.

Eastop and Hille Ris Lambers (1976) listed 11 species as valid, under *Ceratovacuna* and considered *Astegopteryx takenouchii* Takahashi as a valid species under *Astegopteryx* ; however, Takahashi (1958), while dealing with species of *Ceratovacuna* in Japan, pointed out that all the species described under *Astegopteryx* from *Styrax* perhaps belong to *Ceratovacuna* and these include *takenouchii*—Takahashi (op. cit) also stated that genera *Astegopteryx* and *Cerataphis* are not found in Japan. In recent years, at least two new species have been described from India under *Ceratovacuna*, viz., *indica* Ghosh, M. R. *et al.* 1974 and *perglandulosa* Basu, Ghosh, Raychaudhuri 1973. Takahashi (1958) has given a key to the aptera and alatae of six species including three unnamed ones on Gramineae in Japan and Raychaudhuri *et al.* (1980) have given a key to the species from Northeast India ; a key to the fundatrigeniae of *nekiashi* Sasaki and *styraci* (Mats.) from Formosa can be found in Takahashi (1936).

A total of six species is now known from Indian region including three endemic ones ; all are known largely from Northeast India, except *nekoashii* which is known only from North West Himalaya, the most commonly distributed species being *C. lanigera* Zehnt.

Biology : Out of 14 species (Table VII) considered under this genus, besides three unnamed species dealt by Takahashi (1958), four have been known from primary host *Styrax*, of which only *C. nekoashii* (Sasaki) presents a complete heteroecious holocycle alternating between *Styrax japonica* and *Oplismenus*. The fundatrigeniae, in Japan, migrate to *Oplismenus* in June and July and summer generations of apterous aliencolae exhibit well developed wax pores ; alatae which act as fall migrants moving over to *Styrax* in October, differ from fundatrigeniae in having long frontal horns and constricted cauda etc. Till the biology of this species was worked out, it had been described under different names on *Styrax* and *Oplismenus* and it is apprehended that unless complete biologies are worked out, aphids inhabiting *Styrax* and various

Graminae may still be identified as different species, while in reality some of them may be morphs of same species.

Many of the species known from Graminae may continue to occur all through the year in temperate region, e.g. *lanigera* on *Miscantius* and *japonica* on Bamboo in Japan ; the selection of secondary host may also vary in different areas of distribution as in the case of *lanigera* which is widely distributed on Sugarcane in South east Asia, is restricted to *Miscanthus* in Japan. The secondary hosts of *Ceratovacuna* include a wide variety of Graminae belonging to *Apluda*, *Arthroxon*, *Bambusa*, *Ischine*, *Miscanthus*, *Oplismenus*, *Schizostachyum*, *Saccharum* etc. of which bamboo appears to be most favoured host.

In Indian region, of the six species, three endemic species viz. *indicus* M.R. Ghosh, *et al.*, *perglandulosa* Basu *et al.*, and *spinulosa* A. K. Ghosh & Roychaudhuri, are known only by apterae viviparae. Recently, detailed biology of *C. silvestrii* and its predator, *Anioslemnia dialatata* on Bamboo in Tripura in Northeast India, has been worked out, [cf. *C. silvestrii*] by Agarwala, *et al.* (*In press*). Natural enemies of *Ceratovacuna* appear to be few and *Anioslemnia dialatata* (Fab.) seems to be one of the most important predator of bamboo aphids e.g. *Astegopteryx bamboosae* (Buckton), *Pseudoregma bucktoni* Doncaster and *Ceratovauna silvestrii* (Tak.) ; of the parasitoids only *Ephedrus plagiator* Needs, has been recorded from *C. silvestrii* Tak. ; *Lipolexis oremae* (Gahan) has been described from *Ceratovacuna lanigera* Zehntner from Philippines by Gahan (1932) and Sary and Schlinger (1967) mentioned about that the same species may also occur in Taiwan. Pulmek (1957) mentioned association of chalcid parasite, *Encarsia flavoscentelium* Zehnt. in Formosa, Java and Philipines, *celeonpteran saucia* Mulsant in Formosa and *Synonymcha grandis* Thulg., in China and Formosa, with *Ceratovacuna lanigera* Zehnt.

Distribution : India ; Sri Lanka ; Thailand ; Malayasia ; Indonesia ; Formosa ; Japan ; Philipines.

Type-species : *Ceratovacuna lanigera* Zehntner. Location of types not known.

Table VII. List of species of *Ceratovacuna* from the world

<i>Species</i>	<i>Host Plant</i>
1. hoffmanni Takahashi, 1936	<i>Setizostachyum larva</i> —
2. japonica (Takahashi, 1924)	<i>Arundinaria simonii</i> ; <i>Bambusa</i> sp. ; <i>Sasara mossa</i>
3. indicus M.R. Ghosh et al., 1974	<i>Bambusa</i> sp.
4. lanigera Zehntner, 1897	<i>Saccharum arundinaceum</i> ; <i>Miscanthus sinensis</i>
5. longifolia (Takahashi, 1929)	<i>Bambusa</i> sp.
6. nekoashi (Sasaki, 1910)	<i>Apluda mutica</i> ; <i>Arthoxon</i> ; <i>Oplismenus</i> ; <i>Styrax</i>
7. panici (v.d. Goot, 1917)	<i>Andrapogon</i> sp., <i>Capiuipidium panicum</i> spp.
8. perglandulosa Basu & Ghosh. R.C., 1973	<i>Graminae Saccharum arundinaceum</i>
9. pseudostyraciphila (Shinji, 1936)	<i>Styrax japonicum</i>
10. silvestrii (Takahashi, 1927)	<i>Bambusa arundinacea</i> , <i>Bambusa</i> spp.
11. spinulosa A.K. Ghosh & Raychaudhuri, 1972	<i>Ischne album</i>
12. sturaci (Matsumura, 1917)	<i>Styrax japonica-Oplismen</i>
13. taikenouchii, Takahashi	<i>Styrax</i>
14. uscare (Tao, 1964)	Bamboo

Note : besides above, Takahashi, (1958) reported *Ceratovacuna* sp. A. from *Sasa sesunensis*, sp. B. from *Microstegium nudum* and sp. C. from *Sasa veitehii* in Japan and stated that these may be aliencolae of aphids described as *Astegopteryx* from *Styrax* in Japan.

Key to the species of *Ceratovacuna* Zehntner

Apterous viviparous female :

1. Dorsum of abdomen with spinal wax-gland cell groups, at least on anterior tergites, pleural wax-gland cell groups variably present .2
- Dorsum of abdomen without spinal and pleural wax-gland cell groups .3

2. Dorsal abdominal hairs with normal or swollen apices. Longest hair on antennal segment III at most equal to the basal diameter of the segment. On Bamboo

.*C. silvestrii* Takahashi

Dorsal abdominal hairs with acute apices. Longest hair on antennal segment III up to $2.20\times$ as long as the basal diameter of the segment. On *Saccharum*, *Grassum*, Bamboo and unidentified grasses

.*C. perglandulosa* Basu, Ghosh & Raychaudhuri

3. Wax gland cells arranged in a transverse row on 8th tergite. Marginal wax gland cells on 1st-7th tergite few, never more than 3-6 in a group. Hairs on siphuncular cone long and fine.

.*C. indica* Ghosh, Pal, Raychaudhuri

Wax gland cells arranged irregularly on 8th tergite. Marginal wax gland cells always more than 3 in a group. Siphuncular hairs short or not discernible

.4

4. Dorsal cephalic hairs up to $4.0\times$ as long as basal diameter of antennal segment III and longest hair on antennal segment III up to $1.3-2.0\times$ as long as the mentioned diameter. Wax gland cell groups an distinct chitinised area. Antennal segment III and IV and femora with spinulose imbrication. On *Ischaemum*

.*C. spinulosa* Ghosh & Raychoudhuri

Bersal cephalic hairs $1.2-2.5\times$ and longest hair on onternnal segment III $0.9-1.0\times$ as long as the basal diameter of the segment III. Wax gland cell groups on pale areas. Antennal segment III, IV nearly smooth. On *Saccharum*

.*C. lanigera* Zehmtner

Alate viviparous female :

- 1(2). Ultimate rostral segment $0.62-0.77\times$ as long as second segment of hind tarsus. Forewings with pterostigma pale. Siphuncular pore ± 0.02 mm. On *Bambusa*

.*C. silvestrii* Takahashi

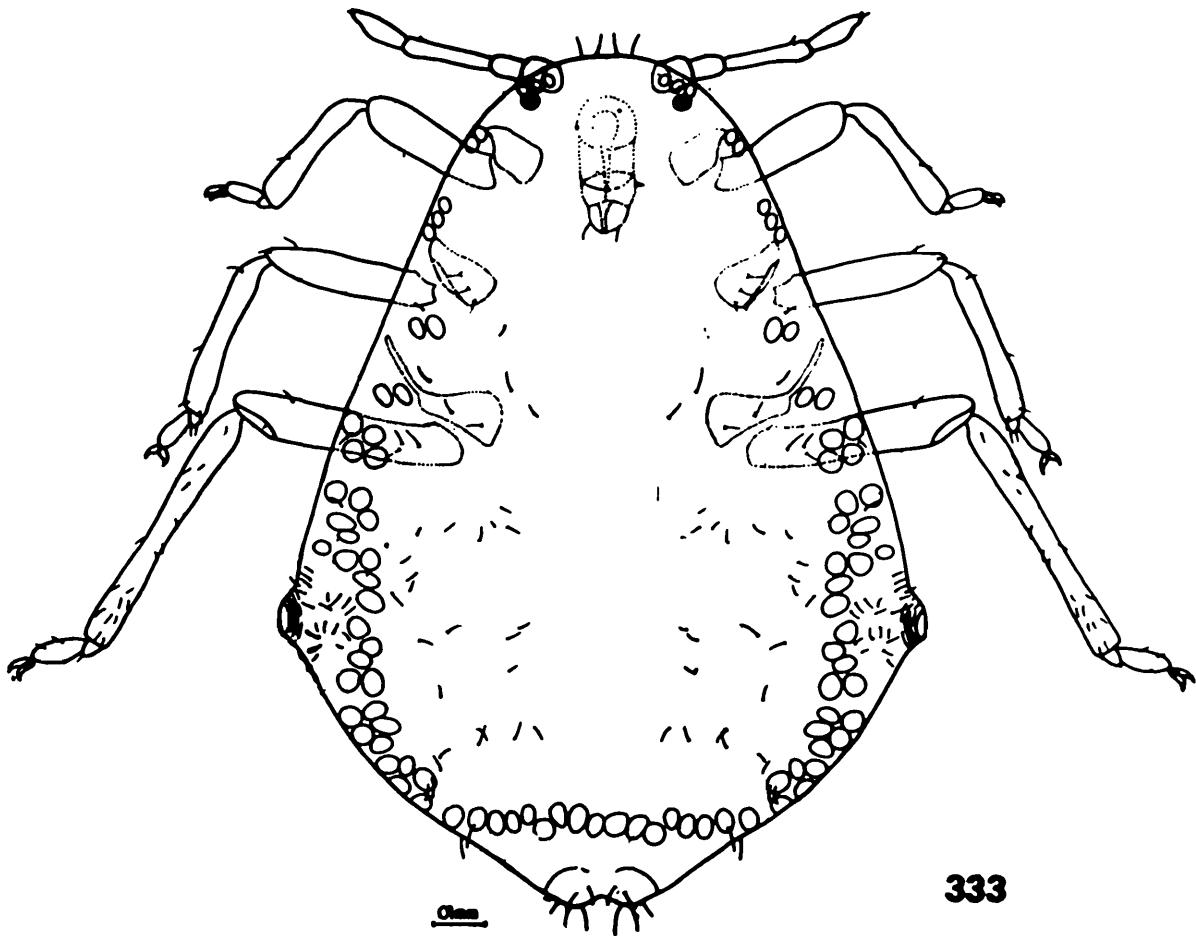
- 2(1). Ultimate rostral segment $0.49-0.55\times$ as long as second segment of hind tarsus. Forewings with pterostigma dark brown. Siphuncular pore ± 0.04 mm. On *Sacc-harum*

.*C. lanigera* Zehntner

50. *Ceratovacuna indica* Ghosh, Pal & Raychaudhuri
(Figs. 333-337)

1974. *Ceratovacuna indica* Ghosh, M.R., Pal, P.K. & Raychaudhuri, D.N. *Proc. zool. Soc. Calcuta*, 27 : 96.
1980. *Ceratovacuna indica*, Raychaudhuri, D.N., Ghosh, M.R., Pal, P.K., & Ghosh, A.K., *In Aphids of North East India and Bhutan*, 370.

Apterous viviparous female : Body elongate, pale, pear shaped, 1.4-1.7 mm long with 0.75-0.90 mm as maximum width. Head and prothorax feebly dusky, smooth ; frontal horns short, pointed each bearing 5-6 hairs, about $0.55-0.75\times$ as long as II antennal segment. Antennae pale, 4-segmented (sometimes with a feeble segmentation on III), $0.21-0.23\times$ as long as the body ; flagellum gradually more distinctly with spinulose imbrication from base of segment III apicad ; hairs on flagellum sparse, 0.016-0.023 mm long, $0.8-1.1\times$ as long as basal diameter of antennal segment III ; processus terminalis $0.33-0.40\times$ as long as base of last antennal segment. Rostrum reaches mid-coxae, ultimate rostral segment short and blunt, $0.57-0.65\times$ as long as second segment of hind tarsus and bears 4 preapical hairs. Abdominal dorsum pale ; hairs on the dorsum fine, flagellate ; on cephalothorax 0.050-0.066 mm long, on abdominal dorsum of similar length, these being $2.5-3.0\times$ ($4.0\times$) as long as the basal diameter of antennal segment III ; 8th tergite with two fine hairs, 0.066-0.073 mm long. Wax glands cells distinct, arranged in paired marginal groupings from head to 7th abdominal segments as follows ; head 2-4, prothorax 3-5 ; mesothorax ; 3-5 ; metathorax 2-4 ; abdominal segments 1st-7th 3-6 ; 8th abdominal segment with a spino-pleural wax gland group of 7-9 cells arranged in a single row. Siphunculi on large cones, dusky, surrounded by 12-14 fine hairs. Cauda transversely oval with 8 hairs. Subanal plate bilobed, each lobe with 8-9 long hairs. Legs pale, smooth ; hairs on femora and tibiae fine, those on hind tibiae 0.033-0.040 mm long, $1.0-1.2\times$ as long



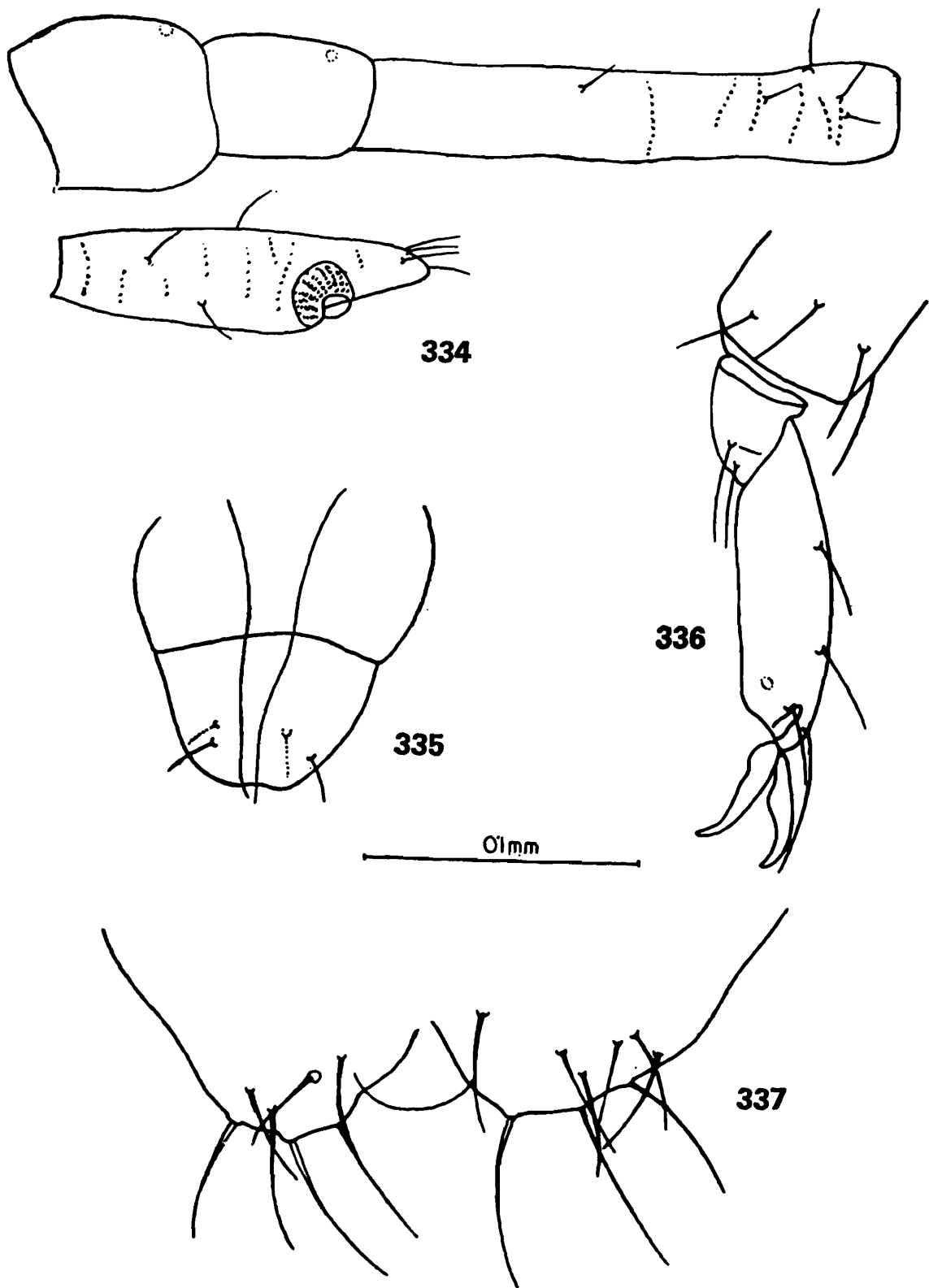
Ceratovacuna indica Ghosh, Pal & Raychaudhuri. Apterous viviparous female :
333, whole body.

as the diameter at the middle of hind tibia ; first tarsal segment
with 3, 2, 2 hairs.

Colour : Yellow in life.

Measurements in mm. :

	Length	Width	Antenna		
1.	1.38	0.75	0.33		
2.	1.58	0.83	0.36		
	Antennal segments		urs	ht ₂	
	III	IV			
	0.15	(0.08+0.026)	0.05	0.093	
	0.16	(0.09+0.025)	0.05	0.097	



Apterous viviparous female : 334, antenna ; 335, ultimate rostral segment, 336, hind tarsus ; 337, caudal region.

(1, 2, ex. Bamboo, Mongpoo, 9.ii.1971, Coll. M.R.G., C.U.).

Nymph : Not available.

Alate viviparous female : Not available.

Material examined : Five apterous viviparous females (Paratypes) from Bamboo, Mangpoo, Darjeeling District, West Bengal, India, 9.ii.1971, Coll. M.R. Ghosh (C.U. Collections).

Discussion : This species appears to be rare in occurrence. It forms moderate-sized colony on lower surface of older leaves of host plant which remain covered with powdery secretion. Both black and red ants (of indet. species) are reported to attend this species. The presence of wax gland cells on marginal group, the arrangement of wax gland cells on 8th abdominal segment and long hairs on siphuncular cones, help to separate the species from related ones.

Distribution : India : West Bengal.

Types : Holotype and Paratypes deposited in the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India.

51. *Ceratovacuna lanigera* Zehntner (Figs. 338-349)

- 1897. *Ceratovacuna lanigera* Zehntner, L., *Meded. Profester Java* (N.S.), 33 : 29.
- 1897. *Ceratovacuna lanigera* Zehntner, L., *Arch. Java Suikerindustrie*, 553.
- 1912. *Oregma lanigera*, van der Goot, P., *Overgedrukt uit. het. Tijd. v. Ent.*, LV ; 321.
- 1921. *Oregma lanigera*, Takahashi, R., *Aphididae of Formosa* 2 : 87.
- 1931. *Ceratovacuna lanigera*, Takahashi, R., *Aphididae of Formosa* 6 : 95.
- 1967. *Ceratovacuna lanigera*, Calilung, V.J., *The Philippine Agriculturist*, L : 110.
- 1969. *Ceratovacuna lanigera* Tao, C.C.C. *Sc. Yb. Taiwan Mus.*, 12 : 60.
- 1974. *Ceratovacuna lanigera*, Ghosh, M.R., Pal, P.K. & Raychaudhuri, D.N., *Proc. zool. Soc. Calcutta*, 27 : 97.

Apterous viviparous female : Body 2.1-2.7 mm long with 1.1-1.6 mm as maximum width. Head and prothorax fused, pale brown to pale ; dorsal cephalic hairs fine, acute at apices, less than 10, anterior to the level of eyes, 0.033-0.066 mm long, longer than the frontal horns, and $1.0-1.8\times$ as long as the basal diameter of antennal segment III. Frontal horns acute, divergent, bearing 6-10 very short hairs upto 0.080 mm long, and $1.2-1.6\times$ (in specimens with 4-segmented antennae) or $1.4-1.9\times$ (in specimens with 5-segmented antennae) as long as antennal segment II. Antennae 4-5-segmented, $0.12-0.16\times$ as long as the body, usually pale brown with apical segments darker ; flagellum gradually more distinctly imbricated, imbrications often spinulose apical ; hairs on the flagellum sparse, longest hair on segment III 0.020-0.043 mm long, $0.90-1.40\times$ as long as the basal diameter of antennal segment III ; processus terminalis $0.33-0.56\times$ as long as the base of last antennal segment. Wax glands when present on cephalothoracic region composed of 3-5 cells and located just below base of antennae and on the posterolateral margin of pronotum. Rostrum reaches forecoxae, ultimate rostral segment $0.45-0.55\times$ as long as second segment of hind tarsus. Abdominal dorsum pale bearing some fine irregular sculpturing ; hairs on the dorsum of abdomen fine, 0.033-0.056 mm long, $1.0-1.8\times$ as long as the basal diameter of antennal segment III ; 7th and 8th tergites, each with 7 spinal hairs, 0.50-0.073 mm and 0.033-0.046 mm long and $1.6-2.5\times$ and $1.0-1.4\times$ as long as the mentioned diameter, respectively. Wax glands may be present laterally on meso-and meta-notum and almost always present on 1st-7th tergites, these glands when fully developed composed of 2-6, round or irregular-shaped cells ; 8th tergite with a median wax gland on pale brown spino-pleural area, composed of 9-27 round or irregular-shaped cells. Siphunculi on slightly elevated cones. Cauda transversely oval bearing 11-12 hairs including two long and thick hairs. Subanal plate bilobed. Legs smooth, pale brown, bearing many long fine hairs, longest one on hind tibiae 0.053-0.063 mm long, $1.1-1.3\times$ as long as the diameter at the middle of hind tibia ; first tarsal segments with 4, 3, 2 or 3, 3, 2 hairs, dorso-apical hairs on second tarsal segments expanded at apices.

Colour : Pale green in life.

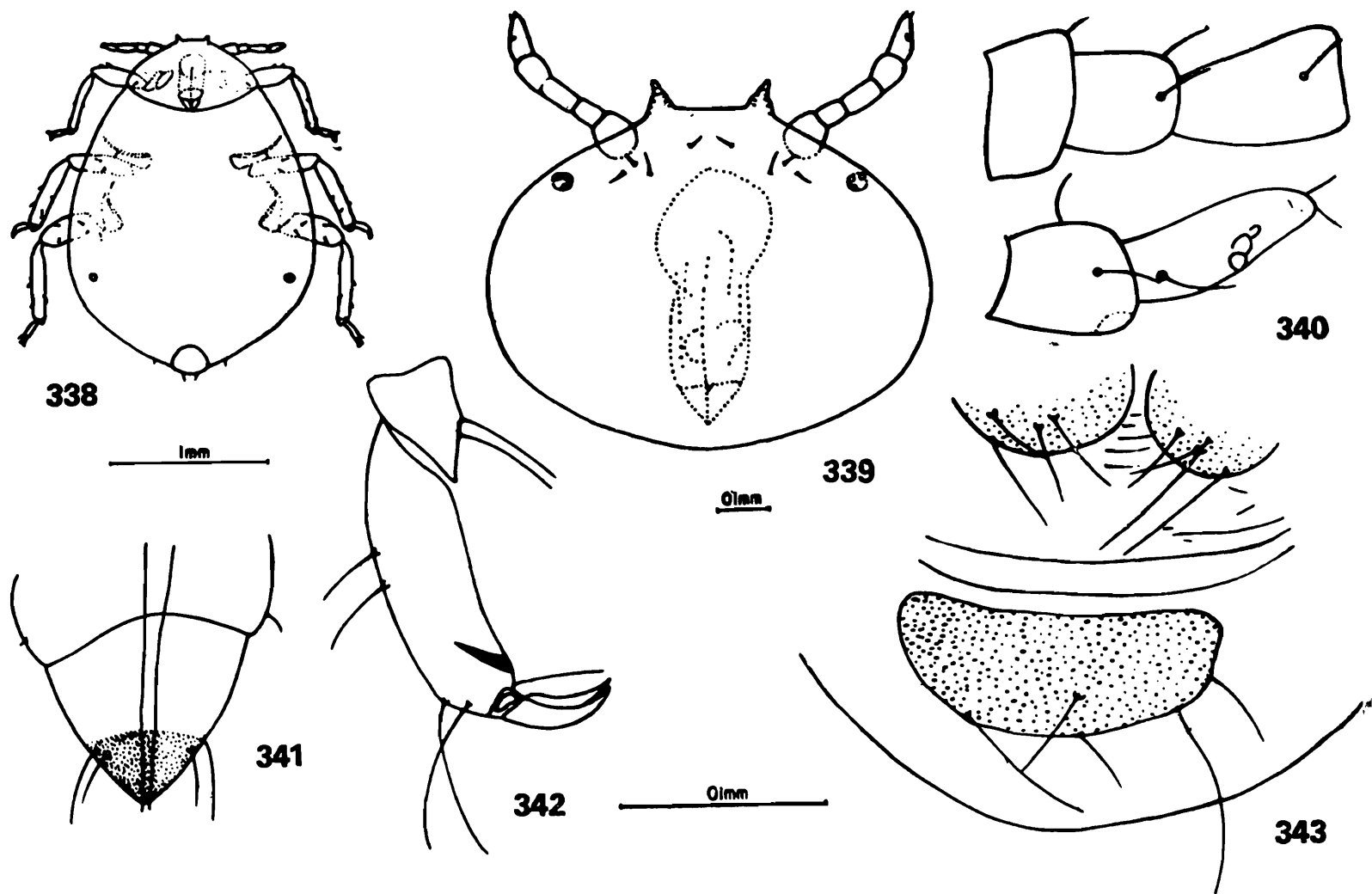
Measurements in mm. :

	Length	Width	Antenna
1.	1.97	1.28	0.29
2.	2.25	1.40	0.37
3.	2.42	1.48	0.35

Antennal segments				urs	ht ₂
I	II	III	IV		
0.05	0.05	0.11	(0.05+0.026)	0.06	0.12
0.06	0.07	0.14	(0.07+0.03)	0.07	0.13
0.04	0.05	0.090	(0.07+0.023)	0.06	0.13

(1, ex *Saccharum officinarum*, Jorhat, Assam, 14.x.1977, ZSI ;
2, 3, *Saccharum officinarum*, Kalimpong, West Bengal, 26.xiii.
1969, 11.ii.1970, C.U.).

Alate viviparous female : Body 2.3-2.6 mm long with 0.90-1.28 mm as maximum width. Head brownish black on anterior portion and darker on posterior portion ; dorsal cephalic hairs fine, 0.03-0.04 mm long, longest one $2.6-2.7\times$ as long as the basal diameter of antennal segment III. Frontal horns short, much reduced. Antennae 5-segmented, $0.24-0.28\times$ as long as the body, with spinulose imbrications on segment III ; hairs on flagellum fine, sparse ; segment III with 21-22 and IV and V each with 4-8 and 4-5 annular secondary rhinaria ; processus terminalis $0.19-0.21\times$ as long as base of last segment. Rostrum reaches little beyond fore-coxae, ultimate rostral segment $0.50\times$ as long as second segment of hind tarsus. Abdominal dorsum pale bearing transverse sclerotic bands on 6th, 7th and 8th tergites ; 7th tergite with 2 long fine spinal hairs, 8th tergite with 6 (sometimes more) hairs, longest one being $2.6-2.7\times$ as long as the basal diameter of antennal segment III. Siphunculi pore-like. Cauda semioval. Legs with femora pale to brown near base, rest dark brown. Wings with venation normal ; media once branched ; pterostigma short.



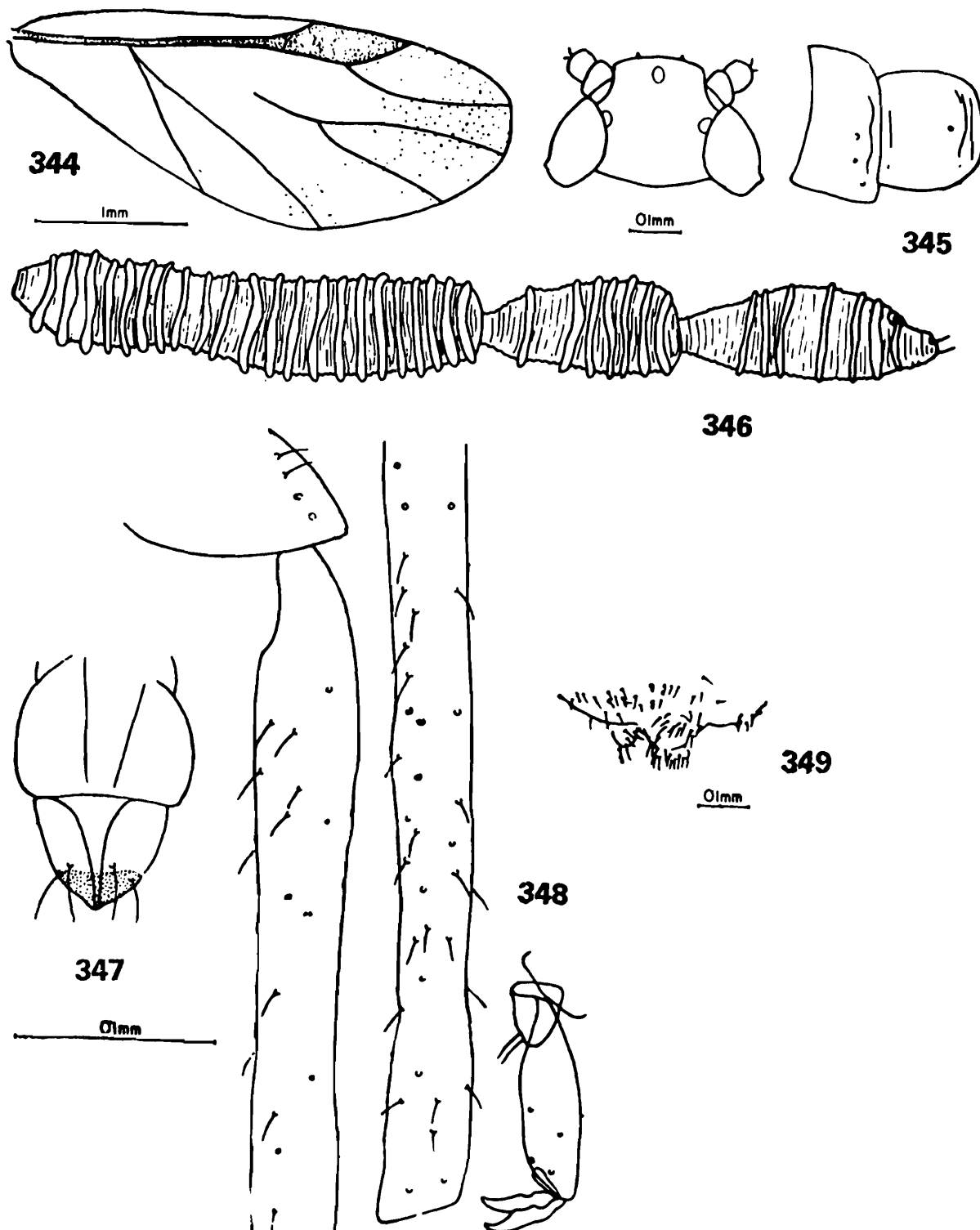
Ceratovacuna lanigera Zehntner. Apterous viviparous female : 338, whole body ; 339, head ; 340, antenna ; 341, ultimate rostral segment ; 342, hind tarsus ; 343, caudal region.

Colour : Black brown in life.

Measurements in mm. :

	Length	Width	Antenna	
1.	2.64	1.28	0.65	
2.	2.34	0.94	0.66	
	Antennal segments			
	III	IV	V	
	0.27	0.13	(0.12+0.02)	urs
	0.28	0.11	(0.13+0.02)	ht

(1, ex *Saccharum officinarum*, Jorhat, Assam, 11.xi.1969, ZSI ;
2, ex *Saccharum officinarum*, Kalimpong, West Bengal, 26.xii.
1969, C.U.).



Alate viviparous female : 344, forewing ; 345 head ; 346, antenna ; 347, ultimate rostral segment ; 348, hind leg ; 349, caudal region.

Nymph (Early stage : apterous) : Body 0.96 mm long with 0.45 mm as maximum width. Head fused with prothorax, dorsal cephalic hairs fine, upto 0.050 mm long, nearly twice as long as basal diameter of antennal segment III, $1.5\times$ as long as antennal segment II. Frontal horns divergent, acute at apex, upto 0.130 mm long, $4.0\times$ as long as antennal segment II, becoming much smaller (0.071 mm) at later stage with body size 1.10 mm. Antennae 4-segmented, little less than $0.16\times$ as long as the body, segment I, II and IV each with single fine hair, segment III with 2 similar hairs, upto 0.033 mm long ; processus terminalis little over half as long as the base of last antennal segment. Abdominal dorsum pale ; dorsal hairs fine, acute, 0.035—0.060 mm long, always longer on posterior tergites ; 8th tergite with 2-3 spinal hairs upto 0.060 mm long. Siphunculi pore-like with thick rims. Cauda with 2 long hairs. Legs pale bearing many fine hairs on femora and tibiae, on hind tibiae 0.030-0.050 mm long, $2.0\times$ as long as the diameter at the middle of tibia ; first tarsal segments with 3, 3, 2 hairs, which are fine and 0.056-0.066 mm long ; dorso-apical hairs on second tarsal segments distinctly expanded at apices.

Colour : Pale green in life.

Measurements in mm. :

	Length	Width	Antenna		
1.	0.96	0.45	0.13		
2.	0.82	0.30	0.17		
	Antennal segments			urs	ht
I	II	III	IV		
0.04	0.04	0.06	(0.50+0.42)	—	0.105
0.04	0.03	0.06	(0.40+0.02)	—	0.100

(1, 2, ex *Saccharum officinarum*, Jorhat, Assam, 24.ix.1976, ZSI).

Material examined : Several apterae from Graminae, Along, Siang dist., Arunachal Pradesh, India, 11.ii.1973, Coll. A. K. Ghosh (ZSI) ; several apterae and alatae from *Saccharum officinarum*, Kalimpong, West Bengal, India, 26.xii.1969 (C.U. Coll.) and Jorhat, Assam, India, 24.ix.1976, 26.xii.1976 (ZSI Colls.).

Discussion : This species has been recorded during the months of October to March on *Saccharum officinarum* (except a stray record on Combretaceae) in northeastern region and also in sugarcane growing area of Uttar Pradesh. Only viviparae are known. Takahashi (1923) mentioned that in Formosa the species infests sugarcane, causing loss of yield ; it also infests lower surface of leaves of *Miscanthus* and he established its host-alternating cycle from *Saccharum* to *Miscanthus* by transfer experiments. No sexuales or intermediate forms have been noted in Formosa and the nymphal stages of apterae lasted for about 10 days and that of alate forms for about 14 days. The young nymphs are reported to be active but apterae remain sedentary in dense colonies. In Japan, the species is reported to be viviparous on *Miscanthus* throughout the year with apterae being common in all seasons and alatae during summer and autumn. No record of infestation on sugarcane is known in Japan (Takahashi, 1958).

In northeastern region of India, the species has been noted to initiate infestation on host plants from under surface of leaves around the midrib and then spread over the entire surface covered with flocculent waxy-secretion. Copious honeydew secretion often cover the upper surface of lower leaves leading to growth of sooty molds. Black ants have been noted to attend the species in same cases.

Distribution : India : Sikkim, West Bengal, Assam, Arunachal Pradesh, Tripura and Uttar Pradesh ; Sri Lanka ; Indonesia ; Formosa ; Japan ; Philippines.

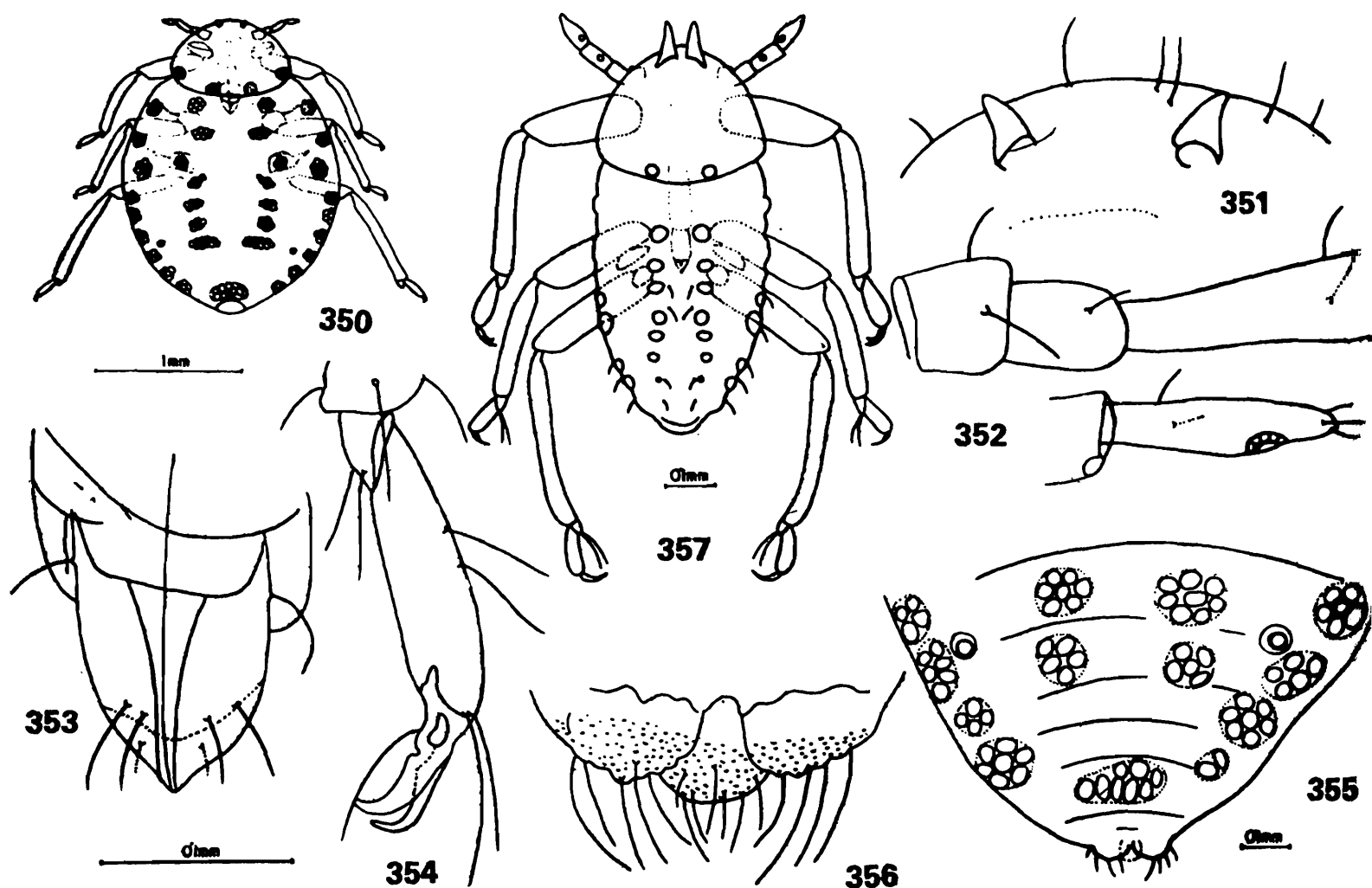
Types : Location of types not known.

52. *Ceratovacuna perglandulosa* Basu, Ghosh & Raychaudhuri
(Figs. 350-357)

1973. *Ceratovacuna perglandulosa* Basu, R.C., Ghosh, P.K. & Raychaudhuri D.N., *Proc. zool. Soc. Calcutta*, **26** : 98.
1980. *Ceratovacuna perglandulosa*, Raychaudhuri, D.N., Ghosh, M.R., Pal P.K. & Ghosh, A.K., *In Aphids of North East India and Bhutan*, 371.

Apterous viviparous female : Body pear-shaped, 1.5-2.2 mm long with 0.80-1.4 mm as maximum width at the middle of abdomen.

Head fused with prothorax, brown on anterior portion ; frontal horns anteriorly directed, 0.28-0.30 mm long, bearing 4 fine short hairs (0.03-0.05) ; cephalic hairs, fine, 0.065-0.075 mm long, 2.0-4.0 $\times$ as long as the basal diameter of antennal segment III. Antennae usually 4-5-segmented, 0.16-0.20 $\times$ as long as the body ; flagellum with distinct spinulose imbrications ; hairs on the flagellum fine, longest hair on segment III 0.026-0.030 mm long, 1.0-1.6 $\times$ as long as the basal diameter of the segment ; processus terminalis 0.30—0.40 $\times$ as long as the base of last antennal segment. Rostrum hardly reaches beyond fore-coxae, ultimate rostral segment wider than long, 0.45-0.55 $\times$ as long as second segment of hind tarsus and without any accessory hairs.



Ceratovacuna perglandulosa Basu, Ghosh, Raychaudhuri. Apterous viviparous female : 350, whole body ; 351, head ; 352, antenna ; 353, ultimate rostral segment ; 354, hind tarsus ; 355, posterior portion of abdomen ; 356, caudal region. Apterous nymph : 357, whole body.

Abdominal dorsum pale, smooth, hairs on the dorsum of abdomen long, fine, longest hair on anterior tergites 0.025-0.033 mm long, $2.0-2.8\times$ as long as the basal diameter of antennal segment III ; 8th tergite with 4 long fine hairs. Wax glands present on posterior portion of cephalothorax, mesothorax, metathorax and on 1st-7th abdominal segments, containing 3-11 oval or irregular cells in marginal and spinal groups ; 8th tergite with a spinopleural, transverse wax gland with 9-24 cells. Siphunculi pore-like. Cauda transversely oval, with a basal constriction and bearing 8-12 hairs. Subanal plate bilobed, each lobe with 8-15 hairs. Legs concolorous with antennae, femora and tibiae smooth ; longest hair on hind tibia 0.04-0.06 mm long, $1.0-1.1\times$ as long as the diameter at the middle of the tibiae ; first tarsal segments with 3, 3, 2 hairs, of which two are long and fine and one short and spine-like on fore-and mid-legs.

Colour : Brownish black in life.

Measurements in mm. :

	Length	Width	Antenna		
1.	1.80	1.10	0.29		
2.	1.68	1.00	0.33		
3.	1.91	1.34	0.35		
	Antennal segments			urs	ht ₂
III	IV	V			
0.10	(0.07+0.02)		0.07	0.12	
0.13	(0.07+0.02)		0.07	0.13	
0.08	0.06	(0.07+0.03)	0.06	0.131	

(1, ex *Bamboo*, Sonapurdi, Jaintia Hills, Meghalaya, 27.viii.1974, ZSI, 2, 3 ex *Saccharum officinarum*, Shillong, Meghalaya, 16.vii.1968, C.U.)

Alate viviparous female : Not known.

Nymph (Apterous ; early stage) : Body of 0.75 mm long, slender with 0.28 mm as maximum width. Frontal horns stout, 0.090-0.93 mm long, acute with 1-2 short, inconspicuous hairs. Cephalic

hairs fine, 0.026-0.50 mm long. Antennae 4-segmented, about $0.25\times$ as long as the body ; flagellum imbricated from anterior half of segment III ; hairs on flagellum fine, 0.023-0.026 mm long, 1-2 on each of segment III and IV ; processus terminalis $0.44\times$ as long as base of last antennal segment. Rostrum reaches beyond mid-coxae, ultimate rostral segment of $0.65\times$ as long as second segment of hind tarsus. Abdominal dorsum pale ; paired spinal and marginal wax glands composed of one cell, present on cephalothorax, meso-and meta-thorax and on 1st-5th abdominal segments ; marginal ones on anterior tergites may be indistinct ; hairs on the dorsum of abdomen long, fine, 6 per segment on each of 1st-6th tergites, 4 on 7th tergite and 2 on 8th tergite, these may be 0.020-0.040 mm long, and spinal and marginal hairs usually much longer than the pleural hairs. Siphunculi poriform, pale. Femora and tibiae smooth bearing many fine hairs upto 0.03-0.05 mm long ; first tarsal segments each with 2 fine hairs upto 0.073-0.076 mm long.

Colour : Pale in life.

Measurements in mm. :

	Length	Width	Antenna		
	0.75	0.28	0.198		
	Antennal segments			urs	ht ₂
I	II	III	IV		
0.03	0.04	0.06	(0.06+0.023)	0.07	0.103

(ex *Bamboo*, Sonapurdi, Meghalaya, 29.viii.1974, ZSI).

Material examined : Many apterous viviparous females and nymphs from *Grassum prothama*, 30.iii.1968, Shillong, Meghalaya ; 30.iii.1968 ; from *Saccharum officinarum*, Shillong, Meghalaya, 16.12.1968, Coll. R.C. Basu ; from unidentified grasses, Shillong, Meghalaya, 12.ii.1970, Coll. H. Banerjee (C.U. Colls.) ; from *Bamboo*, Sonapurdi, Meghalaya, 27.viii.1974, Coll. A.K. Ghosh (ZSI Colls.).

Discussion : The species form compact colonies on the lower surface of leaves of host plants (Bamboo, Sugarcane etc.) and appears to be common on grasses in Northeast India specially in Kalimpong, Darjeeling hills of West Bengal, where Pal (1975) reported the occurrence throughout the year and even upto c 2000 m altitude. The colonies remain covered with white waxy secretion and the insects secrete copious honey dew and are often attended by ants. Originally described from Meghalaya, the species is now known from entire northeastern region from *Bambusa* spp., *Grassum prothama*, *Saccharum officinarum*, *Setaria* and indet grasses, mostly occurring during September to March.

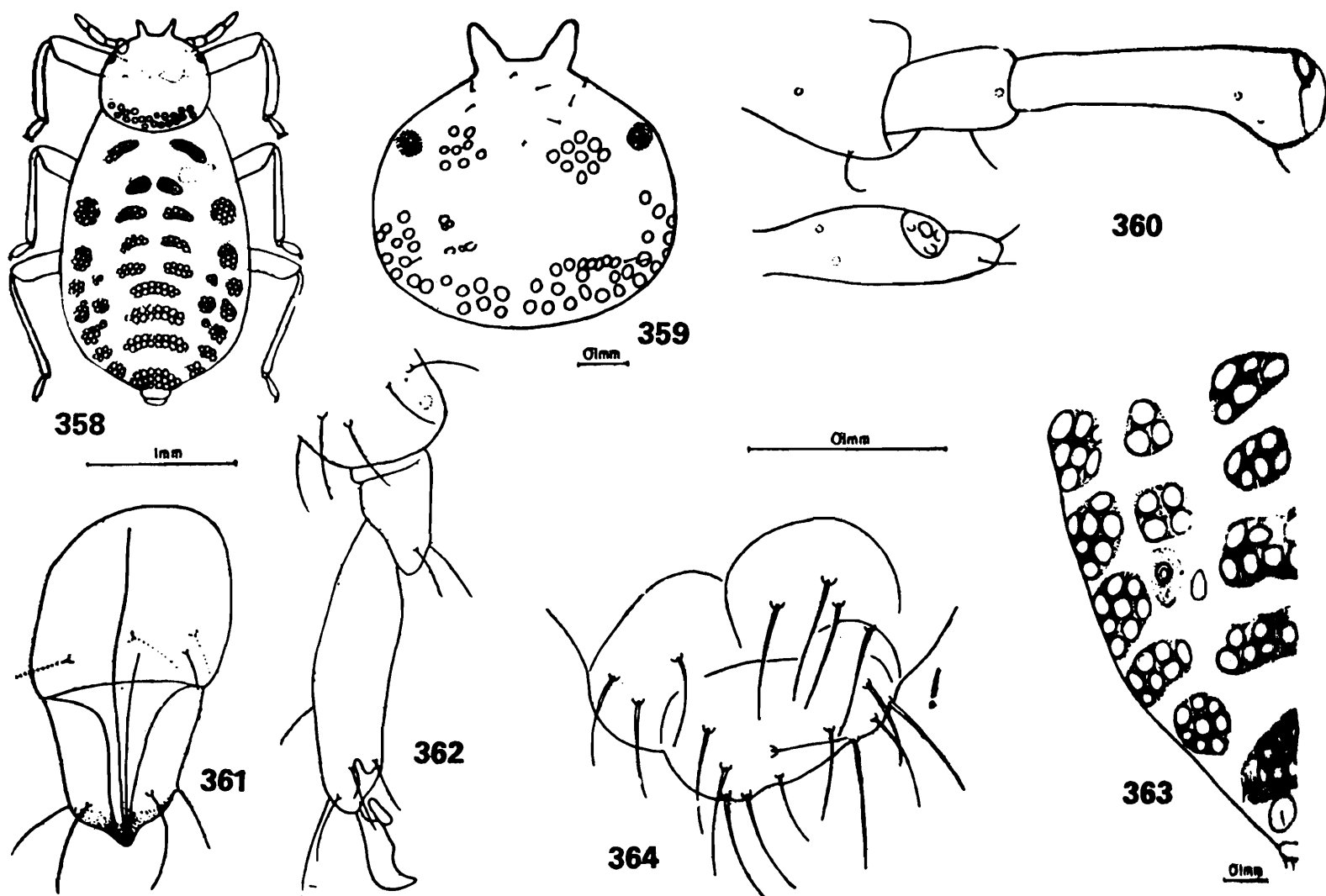
Distribution : India : Arunachal Pradesh, Assam, Meghalaya, Sikkim, West Bengal.

Types : In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India.

53. *Ceratovacuna silvestrii* (Takahashi) (Fig. 358-371)

- 1927. *Oregma silvestrii* Takahashi, R., *Bull. Lab, zool. Gen. agric. Portici*, **20** : 148.
- 1932. *Ceratovacuna arundinariae* Takahashi, R., *Phillippine J. Sci.*, **48** : 71.
- 1966. *Oregma subglandulosa* Hille Ris Lambers, D. and Basu, A.N., *Ent. Bericht.*, **26** : 19.
- 1971. *Pseudoregma subgandulosa* Ghosh, A.K. and Raychaudhuri, D.N., *Sci. Cult.*, **37** : 483.
- 1973. *Ceratovacuna silvestrii*, Ghosh, A.K., *Orient. Ins.*, **7** (3) : 347.
- 1969. *Ceratovacuna silvestrii*, Tao, Charles Chia Chu. *Sci. Yb. Taiwan Mus.*, **12** : 64.
- 1984. *Ceratovacuna silvestrii*, Agarwala, Basant K., Saha, S., Ghosh, A.K., *Rec. zool. Surv. India*, **81** : 13.

Apterous viviparous female : Body 1.5-2.4 mm long with 0.90-1.45 mm maximum width. Head dark brown, fused with prothorax, bearing a pair of short, thick, frontal horns, which are rounded at apices and 0.03-0.04×as long as the body ; cephalic hairs fine, 0.040-0.066 mm long, 1.10-2.5×as long as the basal diameter of antennal segment III. Antenna 4th-5th segmented, with segment I



Ceratovacuna silvestrii (Takahashi), Apterous viviparous female : 358, whole body ; 359, head ; 360, antenna ; 361, ultimate rostral segment ; 362, hind tarsus ; 363, portion of abdomen ; 364, caudal region.

and IV-V dark brown, rest paler, $0.13-0.17\times$ as long as the body ; flagellum variably imbricated ; hairs on antennae fine, sparse, 0.2 per segment, 0.016-0.022 mm long, usually shorter than the basal diameter of antennal segment III ; processus terminalis $0.21-0.33\times$ as long as base of last antennal segment. Rostrum reaches mid-coxae, ultimate rostral segment without any accessory hair, $0.65-0.75\times$ as long as second segment of hind tarsus. Abdominal dorsum pale bearing wax glands on dark brown sclerotic plate-like areas ; hairs on the dorsum of abdomen fine, flagellate, on anterior tergites 0.033-0.050 mm long, $1.1-2.0\times$ (- $3.20\times$) as long as the basal diameter of antennal segment III, on 7th and 8th tergite upto 0.070

mm long, $2.2 \times (-3.2 \times)$ as long as the mentioned diameter. Wax glands arranged segmentally, 2 on anterior and 4 on posterior part of cephalothorax, 6 each on meso- and meta-thorax and 1st-6th abdominal segments, of these spinal and pleural wax glands often fused medially on 4th-6th segments, 7th abdominal segment with a pair of marginal wax gland and 8th segment with a large transverse spino-pleural wax gland. Wax gland cells irregular, always distinctly separated from one another and may be in groups of 2-14 cells in each gland, minimum number being always evident in pleural gland. Siphunculi small with thick sclerotic rims. Cauda semi-oval with 12-19 hairs. Subanal plate bilobed, each lobe with 8-12 fine hairs. Legs darker on basal segments, tibiae and tarsi paler; femora and tibiae bearing many fine flagellate hairs, longest one on hind tibiae 0.045-0.050 mm long, about equal to the diameter at the middle of hind tibiae; first tarsal segments with 3, 3, 2 hairs.

Colour : Dark brown to black in life.

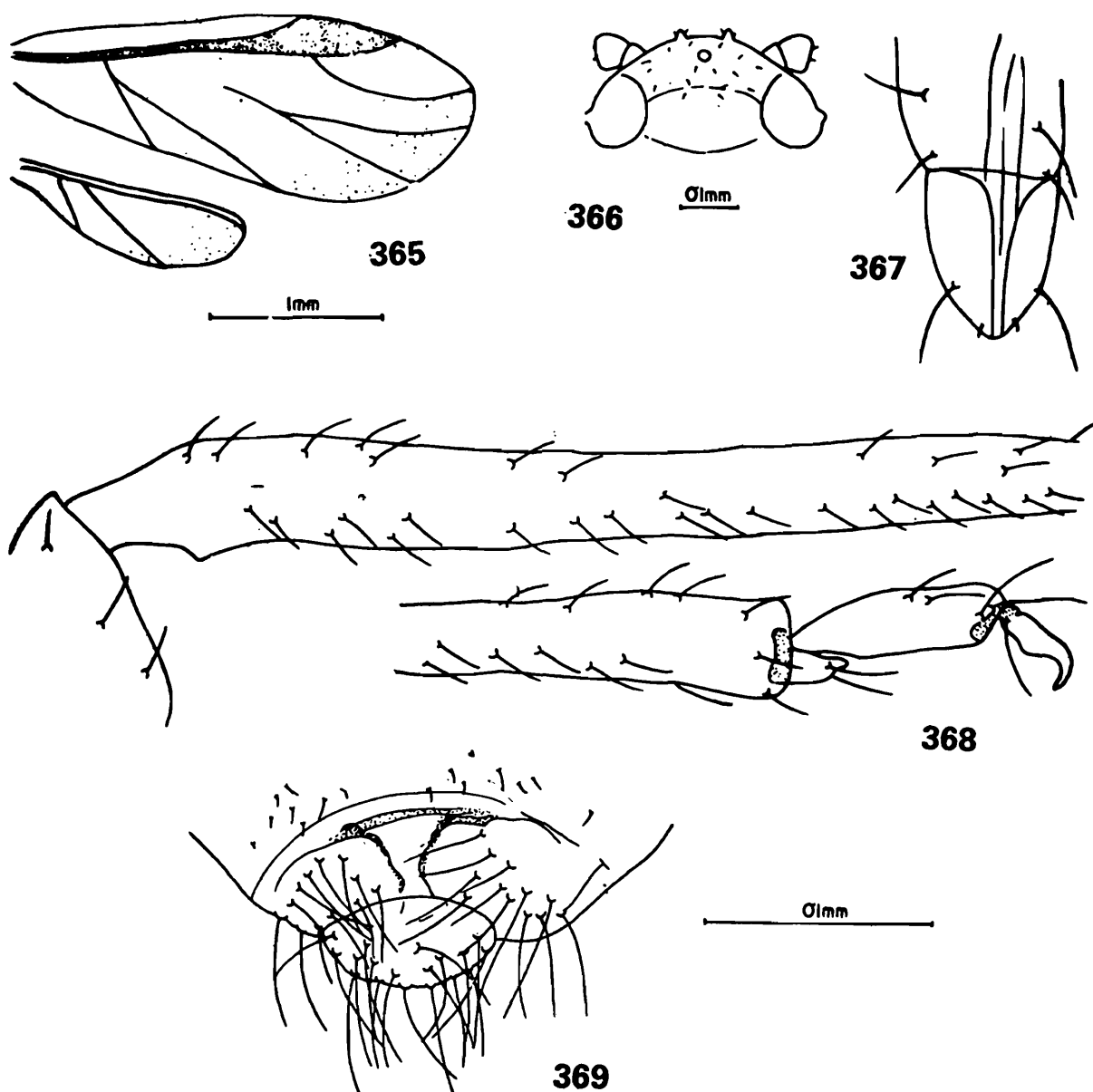
Measurements in mm. :

	Length	Width	Antenna	
1.	1.96	1.12	0.30	
2.	1.95	1.20	0.32	
3.	1.79	0.96	0.34	
4.	1.99	1.10	0.34	

Antennal segments			urs	ht ₂
III	IV	V		
0.10 (0.07+0.02)		—	0.09	0.13
0.08	0.04	(0.07+0.03)	0.08	0.11
0.13 (0.07+0.02)		—	0.09	0.12
0.13 (0.07+0.02)		—	0.09	0.12

(1, 2 ex *Bambusa arundinacea*, Shillong, Meghalaya, 1.xii.1969, C.U. ; 3,4 ex. Bamboo, Mawphalang, Meghalaya, 12.i.1973, ZSI).

Nymph (Apterous : early stage) : Body 0.82 mm long. Head dark brown, prothorax fused with head; frontal horns straight,



Alate viviparous female : 365, wings ; 366, head ; 367, ultimate rostral segment ; 368, part of hind leg ; 369, caudal region.

pointed at apices, nearly $0.10\times$ as long as the body. Antennae 4-segmented, slender, $0.23\times$ as long as the body, segments I and II and segments III and IV subequal to each other ; processus terminalis $0.44\times$ as long as base of last antennal segment. Rostrum reaches hindcoxae, ultimate rostral segment $0.72\times$ as long as second segment of hindtarsus. Dorsum with lateral and spinal sclerotic areas bearing paired marginal and spinal wax glands on meso- and meta-thorax and 1st-7th abdominal segments ; pleural wax glands only evident on anterior segments ; each wax gland with at most

1-2 cells ; 8th tergite with a spinopleural wax gland. Legs pale, long, all femora similar.

Colour : Pale in life.

Measurements in mm. :

Length		Width	Antenna		
0.82		0.38	0.24		
Antennal segments				urs	ht ₂
I	II	III	IV		
0.03	0.04	0.08	(0.026+0.060)	0.016	0.006

(ex Bamboo, Mowphlang, Meghalaya, 12.i.1973, ZSI).

The different nymphal instars can be separated by the following keys :

Key to Nymphal Instars and adult

1. Body without siphunculi ; F.t.C., 2, 2, 3 ;
Maximum length of the body 0.90 mm .First instar nymph

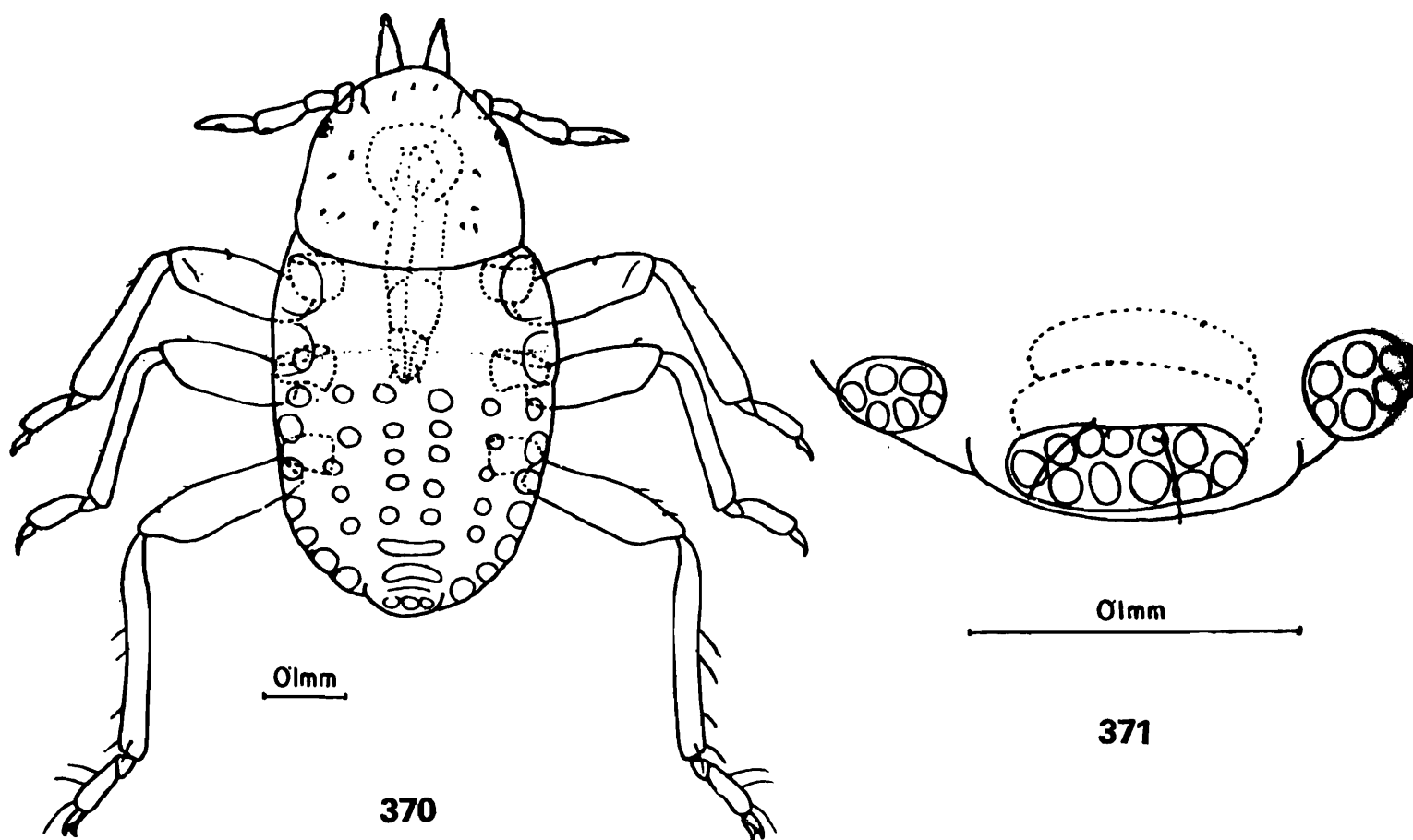
Body with siphunculi, F.t.C., 3.3.3 2
2. Cephalothorax with each wax gland consisting of 5-6 wax gland cells ; Body 0.93-1.30 mm long and 0.50-0.67 mm wide .Second instar nymph

Cephalothorax with each wax gland consisting 7-9 of wax gland cells ; Body never less than 1.28 mm long .. 3
3. Cauda rounded ; subanal plate undivided ;
Body and antenna 1.28-1.49 mm and 0.26-0.27 mm long respectively ; maximum diameter of siphuncular pore 0.09 mm Third instar nymph

Cauda knobbed ; subanal plate bilobed ;
Body and antenna never less than 1.87 and 0.30 mm long respectively 4
4. Frontal horns 0.10-0.13 mm long ; Body 1.87-2.11 mm long .Fourth instar nymph

Frontal horns 0.06-0.08 mm long ; Body 2.03-2.20 mm long Adult apterae viviparae

Alate viviparcus females : Body 2.10-2.30 mm long. Head dark bearing a pair of short, thick, dark frontal horns ; dorsal cephalic hairs short, upto 0.016-0.023 mm long. Antennae dark brown, 5-segmented, $0.27-0.30\times$ as long as the body ; segment III with 20-28, IV with 9-12, V with 8-10 annular secondary rhinaria ; hairs on flagellum short and sparse ; processus terminalis $0.14-0.20\times$ as long as base of last antennal segment. Rostrum reaches atmost near midcoxae, ultimate rostral segment $0.62-0.74\times$ as long as second segment of hind-tarsus. Abdominal dorsum pale, bearing paired marginal sclerites on 6th and 7th tergites and transverse spino-pleural sclerites on 6th-8th tergites ; wax glands not evident ; hairs on the dorsum of abdomen fine, with acute apices, upto 0.030-0.040 mm long. Siphunculi poriform. Cauda with 17-22 fine hairs. Subanal plate bilobed, with 9-11 hairs on each lobe. Legs dark to pale brown ; hairs on femora and tibiae fine, those on hind tibiae 0.016-0.030 mm long, $0.4-1.10\times$ as long



Apterous nymph : 370, whole body ; 371, caudal region.

as the diameter at the middle of hind tibia ; first tarsal segments with 3, 3, 2 hairs. Forewings with radial sector gently curved, media twice branched, cubitus and anal united at base, all veins being distinct, brownish ; hindwings with both obliques.

Colour : Dark brown in life.

Measurements in mm. :

	Length	Width	Antenna	
1.	2.24	1.05	0.67	
2.	2.31	1.05	0.65	
	Antennal segments			
	III	IV	V	ht ₂
	0.27	0.11	(0.12+0.02)	0.08
	0.26	0.12	(0.13+0.02)	0.08

(ex *Bambusa arundinacea*, Shillong, Meghalaya, 1.xii.1969, C.U.).

Material examined : Many apterous and alate viviparous females and nymphs from Bamboo, Dibrugarh, Assam, 12.ix.1969, Coll. H. Banerjee ; Shillong, Meghalaya, 26.x.1968, 3.i.1969, 1.ii.1969, Coll. R.C. Basu ; Mawphlong, Meghalaya, 12.i.1973, Coll. A.K. Ghosh ; Nagarajan, Nagaland, 6.ii.1969, Coll. H. Banerjee ; Takadah, Darjeeling district, West Bengal, 30.v.1969 ; Peshek, Darjeeling district, West Bengal, 22.vi.1971, Coll. M. R. Ghosh (C.U. Colls.),

Discussion : This species, originally described from China, was recorded as a new species, *subglandulosa* from Darjeeling in West Bengal. The dark brown insects form dense colonies on undersurface of older leaves of Bamboo and secrete profuse honey dew, resulting in the formation of sooty moulds. Pal (1975) reported its occurrence throughout the bar in Kalimpong-Darjeeling region and recorded its distribution between c 300 m to 2100 m, more frequently around c 750-1250 m with peak period of

infestation in March and April. Available material indicate in occurrence largely during October-January in northeastern India but some collections have also been recorded during February to June. Ants often attend these aphids. Field studies in Tripura in northeastern region indicate that *silvestrii* starts population build-up on *Bambusa arundinacea* during the month of December and nymphs disperse by wind from end of March to third week of May. Ants [*Camponotus* sp., and *Triglyphothorix lanugioisa* (Mayer)] are reported to visit this aphid species. *Trioxys indicus* acts as a primary parasite of this species during March and coccinellid predators, viz., *Anisolemnia dilatata*, *Scymnus* sp., *Micromus* spp., and also *Calliphora palto* and *Synchona grandis* are known to predate on the species in India (Agarwala, Saha and A.K. Ghosh, 1984).

Distribution : India : Arunachal Pradesh, Assam, Manipur, Tripura, Nagaland, Meghalaya, Sikkim, West Bengal ; China.

Types : Probably in the collections of Agricultural Research Institute, Taipei, Taiwan.

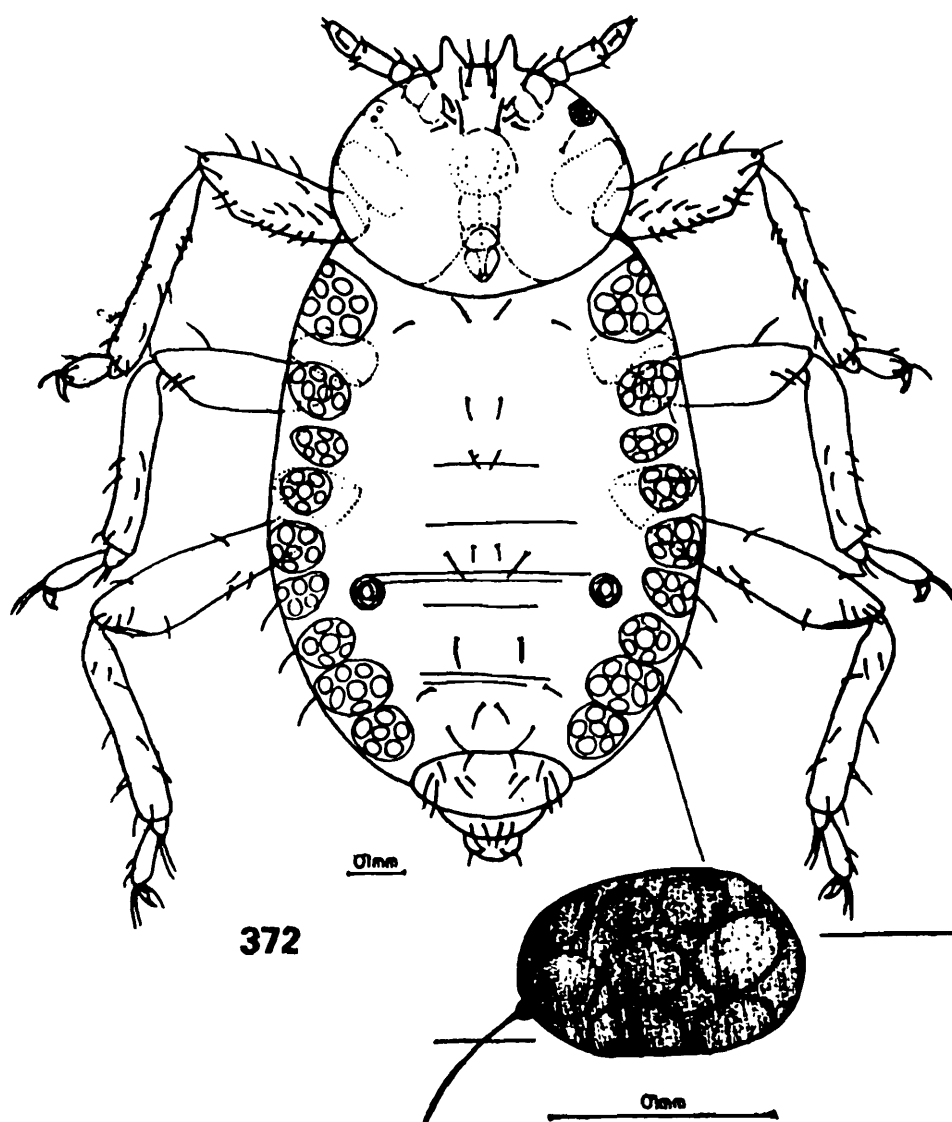
54. *Ceratovacuna spinulosa* Ghosh and Raychaudhuri (Figs. 372-377)

1972. *Ceratovacuna spinulosa* Ghosh, A.K. and Raychaudhuri, D.N., *Proc. zool. Soc. Calcutta*, **25** : 103.

1974. *Ceratovacuna spinulosa*, Ghosh, M.R., Pal, P.K. and Raychaudhuri, D.N., *Proc. zool. Soc. Calcutta*, **28** : 101.

1980. *Ceratovacuna spinulosa*, Raychaudhuri, D.N., Ghosh, M.R., Pal, P.K., and Ghosh, A.K., *In Aphids of Northeast India and Bhutan*, 372.

Apterous viviparous female : Body oval, 1.2-1.4 mm long with 0.76-0.90 mm as maximum width. Head fused with pronotum, pale brown, bearing a pair of frontal horns which are bluntly pointed at apex and little longer than antennal segment III ; dorsal cephalic hairs with acute apices, 0.046-0.068 mm long, 3.0-4.5× as long as the basal diameter of antennal segment III. Antennae pale, 4-segmented, 0.20-0.21× as long as the body ; flagellum with fine spinulose imbrication ; hairs on flagellum sparse, 0.021-0.023 mm long, longest one on segment III, 1.4×



Ceratovacuna spinulosa Ghosh & Raychaudhuri. Apterous viviparous female : 372, whole body.

as long as the basal diameter of the segment. Rostrum reaches near midcoxae, ultimate rostral segment $0.48-0.50\times$ as long as the second segment of hind tarsus and without any accessory hairs. Abdominal dorsum sclerotic in wax gland areas, rest pale ; hairs on the dorsum of abdomen fine, $0.025-0.040$ mm long, $1.6-2.5\times$ as long as the basal diameter of antennal segment III ; 7th and 8th tergites each with 2 fine hairs. Wax glands present as follows ; cephalothorax with an anterior pair of wax glands each with 5.6 cells and a posterior pair of wax glands each with 3-4 cells ; mesothorax, metathorax and 1st-7th abdominal segments each with paired marginal wax glands, thoracic glands

being composed of 9-12 cells, abdominal ones of 5-9 cells ; 8th tergite with a spino-pleural wax gland, composed of 11-12 cells. Siphunculi pore-like without any hairs. Cauda constricted to base and bearing 4-5 hairs of which two are long (0.047 mm) and stout. Subanal plate bilobed, with 6-7 hairs on each lobe. Legs concolourous with the head ; fore-and mid-femora with spinulose striae ; hairs on femora and tibiae fine, 0.015-0.037 mm long, longest one on hind tibiae upto $2.0\times$ as long as the diameter at the middle of the tibia, first tarsal segments with 3, 3, 2 hairs, of which two hairs on fore and mid-tarsi fine and median one is thick and much shorter.

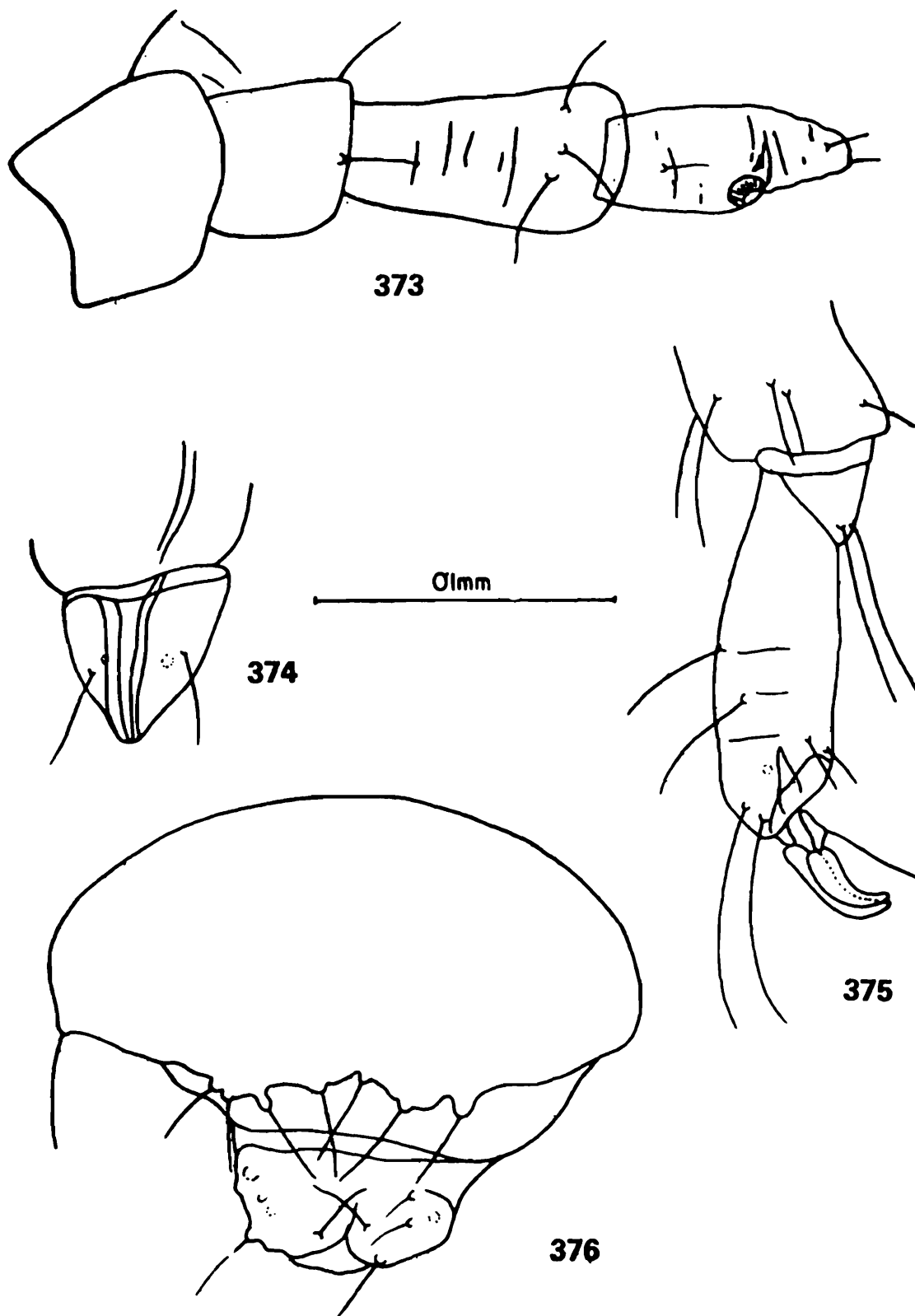
Colour : Deep brownish in life.

Measurements in mm. :

	Length	Width	Antenna
1.	1.25	0.83	0.25
2.	1.44	0.90	0.29
	Antennal segments		
	III IV	urs	ht ₂
	0.08 (0.05+0.02)	0.05	0.09
	0.10 (0.06+0.02)	0.06	0.11

(1, 2 ex *Ischaemum album*, Darjeeling, 7.ii.1970, C.U.).

Nymph (Apterous : early stage) : Body 0.69 mm long ; cephalothorux dark brown ; frontal horns distinct, 0.065 mm long with semiacute apices ; hairs on cephalothorux fine, 0.040-0.050 mm long. Antennae 4-segmented, $0.22\times$ as long as the body, with fine spinulose imbrications on segment III and IV ; hairs on antennae fine, acute, 0.013-0.016 mm long. Rostrum short, stout, ultimate rostral segment $0.60\times$ as long as the second segment of hind tarsus. Abdominal dorsum pale ; marginal wax gland on sclerotic plates, cells not evident clearly ; hairs on the dorsum of abdomen fine, 0.010-0.023 mm long. Legs pale, thick, stout ; hairs on femora and tibiae fine, acute, 0.016-0.040 mm long ;



Apterous viviparous female : 373, antenna ; 374, ultimate rostral segment ; 375, hindtarsus ; 376, caudal region.

first tarsal segments with 2, 2, 2 hairs ; dorso-apical hairs on second tarsal segment 0.080 mm long, flattened at apices.

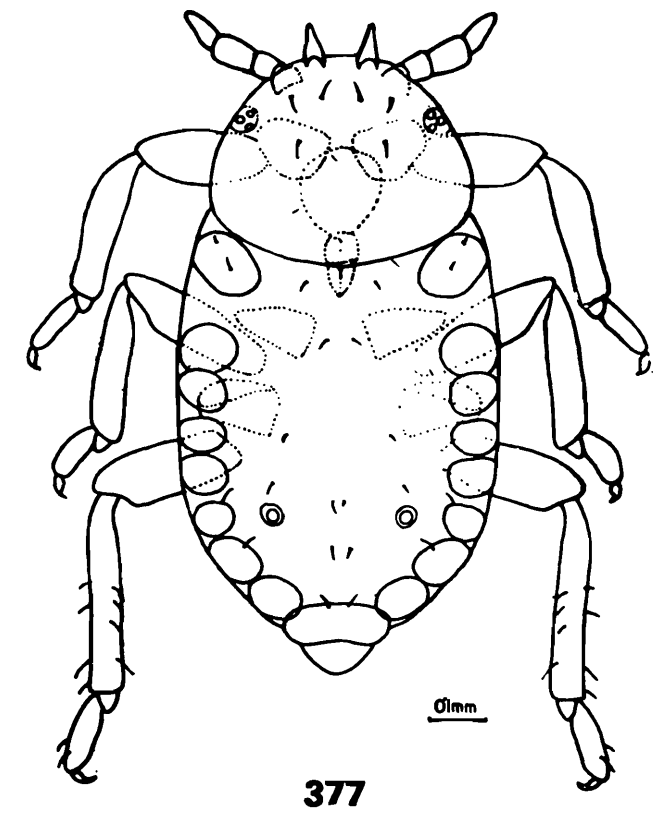
Colour : Pale brown.

Measurements in mm. :

Length		Antenna		I
0.69		0.16		0.03
Antennal segments				
II	IIII	IV	urs	ht ₂
0.03	0.04	(0.05+0.016)	0.046	0.083

(ex Grass, Lebong, Darjeeling, 28.i.1070, C.U.).

Alate viviparous female : Not known.



Apterous nymph : 377, whole body.

Material examined : One apterous viviparous female and two nymphs from indet, grass, Darjeeling, West Bengal, 28.5.1970, C.U. Colls ; Three apterous viviparous females and one nymph from *Ischaemum album*, Darjeeling, West Bengal, 7.ii.1970, coll. S.D. Chakrabarti (Types, C.U. Colls.) ; Two apterous viviparous females and 5 alate nymphs, from grass, Shillong, Meghalaya, 19.xii.1968 (C.U. colls.).

Discussion : This species infests leaves of grasses of temperate condition and makes small wax covered colonies. Ghosh, A.K. *et al.* (1970) earlier recorded the species as *Ceratovacuna ? nekoashii* (Sasaki) from Meghalaya. Raychaudhuri, D. (1978) recorded the species from Manipur and in all likelihood this species, as other endemic ones may be distributed from Darjeeling-Sikkim to entire northeastern region.

Distribution : India : West Bengal, Meghalaya, Manipur.

Types : In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India.

Genus 21. *Chaitoregma* Hille Ris Lambers and Basu, 1966

1966. *Chaitoregma* Hille Ris Lambers, D. and Basu, A.N. *Ent. Ber. Amst.*, **26** : 15 ; Raychaudhuri, D.N., Ghosh, M.R., Pal, P.K. and Ghosh, A.K., 1980. *In* Aphids of North-East India and Bhutan, 372. Type species : *Oregma tattakana* Takahashi.

Morphology : Body 1.5-1.8 mm long, dark sclerotic in apterae and broadly oval. Head fused with pronotum with a pair of frontal horns which are semioval or narrowed at apex. Antennae in apterae 4-segmented, about $0.15-0.17 \times$ as long as the body ; flagellar hairs fine, short and sparse ; processus terminalis $0.33-0.58 \times$ as long as the base of last antennal segment ; primary rhinaria round, protuberant and ciliated. Eyes of 3 facets in apterae. Rostrum hardly reaches beyond forecoxae ; ultimate rostral segment blunt, bearing only preapical hairs. Meso- and metanotum mutually free, as also 1st and 8th abdominal segments ; abdominal segments 2nd-7th completely fused. Tergum sclerotic with stippled warts. Dorsal hairs long and sparse. Siphunculi poriform, without any hairy cones. Cauda constricted at base.

Subanal plate distinctly bilobed. Legs short with trochanters nearly fused with femora ; first tarsal segment with 3,3,3 or 3,3,2 hairs ; dorso-apical hairs on 2nd tarsal segment long and with funnel-staped apices. Nymphs with blunt frontal horns.

Discussion : This is a small genus with only two species, *tattakana* (Takahashi, 1925) and *aderuensis* (Takahashi, 1935) and a subspecies of *tattakana* described from Suisha, as var. *suishana* Takahashi, 1929. All these species originally described under *Oregma*, were known from Formosa and infest Bamboo. No morphs other than apterae and nymphs of apterous viviparous female, are known. *C. tattakana* (Takahashi), first recorded in India by Hille Ris Lambers and Basu (1966) is only known from Darjeeling district of West Bengal but appears to be highly restricted in some specific localities of the area. All the species occur in high altitudes, in India and Formosa.

Biology : Members of this genus infest *Arundinaria* and *Bambusa* ; *C. tattakana* Takahashi appears to be specific to *Arundinaria* both in Formosa and in India. All the species infest undersurface of leaves of the host plants ; heavy infestation may lead to withering of leaves. Ants are not known to visit these aphids. *C. aderuensis* (Takahashi) is reported to infest *Bambusa* in Formosa during the months of November-January. *C. tattakana* (Takahashi) exhibits heavy infestation on *Arundinaria* in April-May in India and Formosa and *C. tattakana suishana* (Takahashi) appears at the same period on *Bambusa* in Formosa.

Distribution : India : West Bengal ; Formosa.

Type species : *Oregma tattakana* Takahashi, 1925, designated by Hille Ris Lambers and Basu, 1966. Probably deposited in the Agricultural Research Institute, Taipei, Formosa.

55. *Chaitoregma takkakana* (Takahashi)

1925. *Oregma tattakana* Takahashi, R., *Dept. Agr. Govt. Res. Inst. Formosa Rept.*, 16 : 47.

1926. *Chaitoregma tattakana*, Hille Ris Lambers, D. and Basu, A.N., *Ent. Ber. Amst.*, 26 : 15.

1969. *Oregma tattakana*, Tao, Charles, C.C., *Sci. Yb. Taiwan Mus.*, 12 : 57.

Apterous viviparous female : Body oval, 1.72 mm long (1.53-1.87 mm) predominantly blackish in colour. Head fused with pronotum, darkbrown, with a pair of cylindrical frontal horns, rounded at their apices, about 0.06 mm long and bearing 3-4 short hairs on distal portion. Hairs on frons and vertex fine, 0.08-0.10 mm long. Antennae blackish, 4-segmented, 0.16 (0.15-0.17)× as long as the body ; segment I and II each with 2 hairs, segment III with 3 hairs on distal half and segment IV with 1 hair on basal half, all hairs long and wavy, longest one on III, 1.3 (1.2-2.0)× as long as the basal diameter of the segment ; processus terminalis less than half the length of base of segment VI. Rostrum short, reaching forecoxae, 0.50 (0.66)× as long as second segment of hindtarsus and bears 3 pairs of preapical hairs. Tergum dark sclerotic, meso-and meta-thorax separated by a colourless intermediate area as also metathorax and 1st abdominal segment ; abdominal segments 2nd-7th fused, segment 8 free, and with 18 hairs ; dorsum with sclerotic roundish stippled warts, appearing like wax gland cells ; hairs on the dorsum of abdomen fine, wavy, with acute apices, 0.06-0.10 mm long, 3.0-5.0 (3.7-6.3)× as long as the basal diameter of III. Siphunculi slightly elevated, apical flange dark. Cauda pale, constricted at base, with 8(10) hairs. Subanal plate pale and bilobed. Legs brownish smooth with at least basal part of tibiae darker ; hairs long and fine, longest one on hind tibia twice the width at the middle of tibia ; first tarsal segments with 3, 3, 3, hairs.

Colour : Brownish to violet, covered by waxy dust (H.R.L. et. Basu).

Measurements in mm. :

	Length		Width		Antenna	
1.	1.72		0.95		0.28	
	Antennal segments				urs	ht ₂
I	II	III	IV			Siph. diam at apex
0.04	0.04	0.09	(0.04+0.25)	0.06	0.10	0.03

(1, ex *Bambusa* sp., Darjeeling, 9.iv.1957, DHRL Colls.).

Alate viviparous female : Not known.

Sexual forms : Not known.

Embryos and larvae : Not known.

Material examined : One apterous viviparous female, from *Bambusa* sp., Darjeeling, India, 9.iv.1957, leg. A.N. Basu, det. D.H.R.L.

Discussion : The species was described by Takahashi (1925) from Tettaka in Formosa, infesting *Arundinaria niitakayamensis*. Hille Ris Lambers and Basu (1966) redescribed the species, while designating the same as the type of genus *Chaitoregma* and mentioned about its heavy infestation on undersurface of leaves of *Arundinaria* sp. in Darjeeling, West Bengal. So far it has not been recorded from any other localities in India.

Distribution : India : West Bengal ; Formosa.

Type : Probably in the collections of Agricultural Research Institute, Taipei, Formosa.

Genus 22. *Doraphis* Matsumura and Hori, 1929

1929. *Doraphis* Matsumura, S. and Hori, H., In Hori, H., *Trans. Sapporo nat. Hist. Soc.*, 10 : 112 ; Takahashi, R., 1929, *Proc. ent. Soc. Wash.*, 3220 ; Shinji, O., 1941, *Monog. Japanese Aphids*, 1108 ; Shinji, O., 1944 ; *Insect Galls and Gall Insects*, 573 ; Tao, Charles, C.C. 1969, *Sc. Yb. Taiwan Mus.*, 12 : 74. Type species ; *Doraphis populi* Hori et Matsumura (= *Sphaerococcus populi* Maskell).
1929. *Paracerataphis* Mordvilko, A.K. *Trudy prikl. Ent.*, 14 : 34.

Type species : *Paracerataphis tremulae* Mordvilko.

Morphology : Body convex dorsally, semicircular, sclerotised, with row of wax gland appearing as tubercles along the entire margin. Head with a pair of strongly pointed frontal horns in normal viviparae (not in aliencolae). Antennae appear rudimentary,

2-3-segmented in apterae, 4-5-segmented in alatae ; secondary rhinaria in alatae, strongly annular. Eyes submarginal, 2-3 faceted in apterae, large in alatae. Rostrum short, ultimate rostral segment shorter than second segment of hindtarsi, without any accessory hairs. Dorsum with dense mosaic-like structure in aliencolae ; 8th tergite separated from consolidated prosoma and abdomen. Siphunculi absent in aliencolae but ring-like in other morphs. Cauda rounded but constricted at base. Subanal plate deeply bilobed. Legs very short and hidden in apterae, fore-and mid-legs without tarsi, hind-legs with 2-segmented tarsi but without claws ; in alatae, legs normal and trochanters fused with femora. Forewings with anal and cubitus united at base for considerable length, media simple, basally faint or appears to be absent ; hindwings with one oblique.

Discussion : This monotypic genus shows very close affinity with *Cerataphis*, and has in the past been often confused with *Cerataphis* specially due to aleurodiform apterae, lateral row of wax glands and paired horns on vertex in other morphs ; the only species, *populi*, has been variously described as a Coccid, *Sphaerococcus* or aphid under *Cerataphis*, *Thoracaphis*, *Paracerataphis* and *Hormaphis*.

Biology : The apterae of *populi* infest bark of small branches of Poplar. The record of alatae from *Pyrus* appears to be accidental, but in the same publication, Shinji (1941) also mentioned *Populus* sp. as the host. The only species is known to lead monocious, anholocyclic life-cycle on *Populus* (eg. *maximowiczii*, *sieboldii*) in Japan. Sorin (1975) states that *D. populi* infests twigs and leaves of poplar trees and seems not to produce any gall. Sorin (*in litt*) mentions that large apterous aleyrodiform adults appear on the twigs in June and believes that these adults hibernate in this form and produce young which grow into small apterous aleyrodiform and the alate viviparous females which emerge from lower side of leaves in the month of July. The species is stated to be very rare in Japan and recent findings in northwestern India and Kashmir indicate its occurrence over wider areas.

Distribution : India ; China ; Korea ; Japan.

Type species : *Doraphis populi* Matsumura et Hori, 1929.
(=*Sphaerococcus populi* Maskell, 1938).

Location of types : Not known.

56. *Doraphis populi* (Maskell)
(Figs 378-394)

1898. *Sphaerococcus populi* Maskell, W.M., *Trans. New Zealand Inst.*, 30 : 248.
1920. *Hormaphis populi*, Takahashi, R., *Zool. Mag.*, Tokyo, 32 : 14.
1929. *Doraphis populi*, Matsumura, S. and Hori. H., *Trans. Sapporo nat. Hist. Soc.*, PO : 112.
1936. *Nipponaphis populi*, Ferris, G. F., *Microent.*, 1 : 15.
1939. *Doraphis populi*, Takahashi, R., *Ins. matsum.*, 13 : 128.
1971. *Doraphis populi*, David, S.K., Narayanan, K., Rajasingh, S.G., 1971. *Madras J. agric. J.*, 58 : 373.
1979. *Doraphis populi*, Rishi, N.D., Abstract., *Symp. Recent Trends in Aphidological studies*, 52.

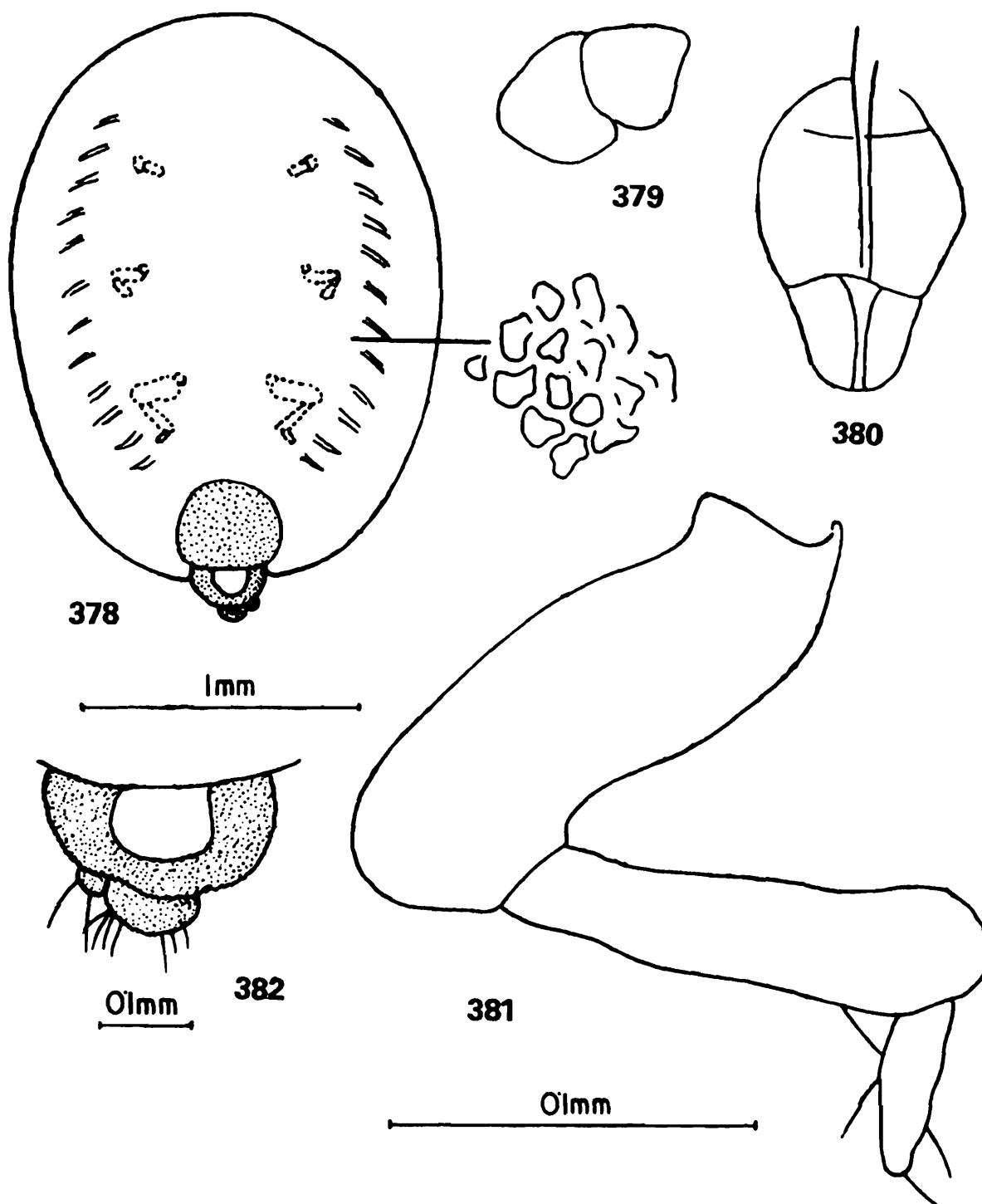
Apterous viviparous female (aliencolae) : Body 2.0-2.3 mm long with 1.7-1.9 mm as maximum with, convex dorsally, strongly sclerotised. Head, thorax and abdominal segments 1-7 entirely fused. Eyes rudimentary, of two facets. Antennae 2-segmented, small, placed ventrally. Rostrum short, reaching forecoxae ; 8th abdominal segment defined from prosoma, rounded on caudal region. Dorsum with dense mosaic-like structure and with row of pustules all along the margin of the body, which are rounded apically, broadened at base and wider than long ; margin appear crenulated due to these pustules. Dorsal hairs hardly discernible. Siphunculi absent. Cauda rounded, constricted at base, with 5-6 hairs. Sub-anal plate bilobed. Legs very short, fore-and mid-legs without tarsi, hind-legs with 2-segmented tarsi, but without claws.

Colour : Brown in colour.

Measurements in mm. :

	Length	Width	Antenna	u.r.s.
1.	2.30	1.93	0.05	0.05
2.	2.34	1.80	0.04	0.05
3.	2.13	1.78	0.05	0.04

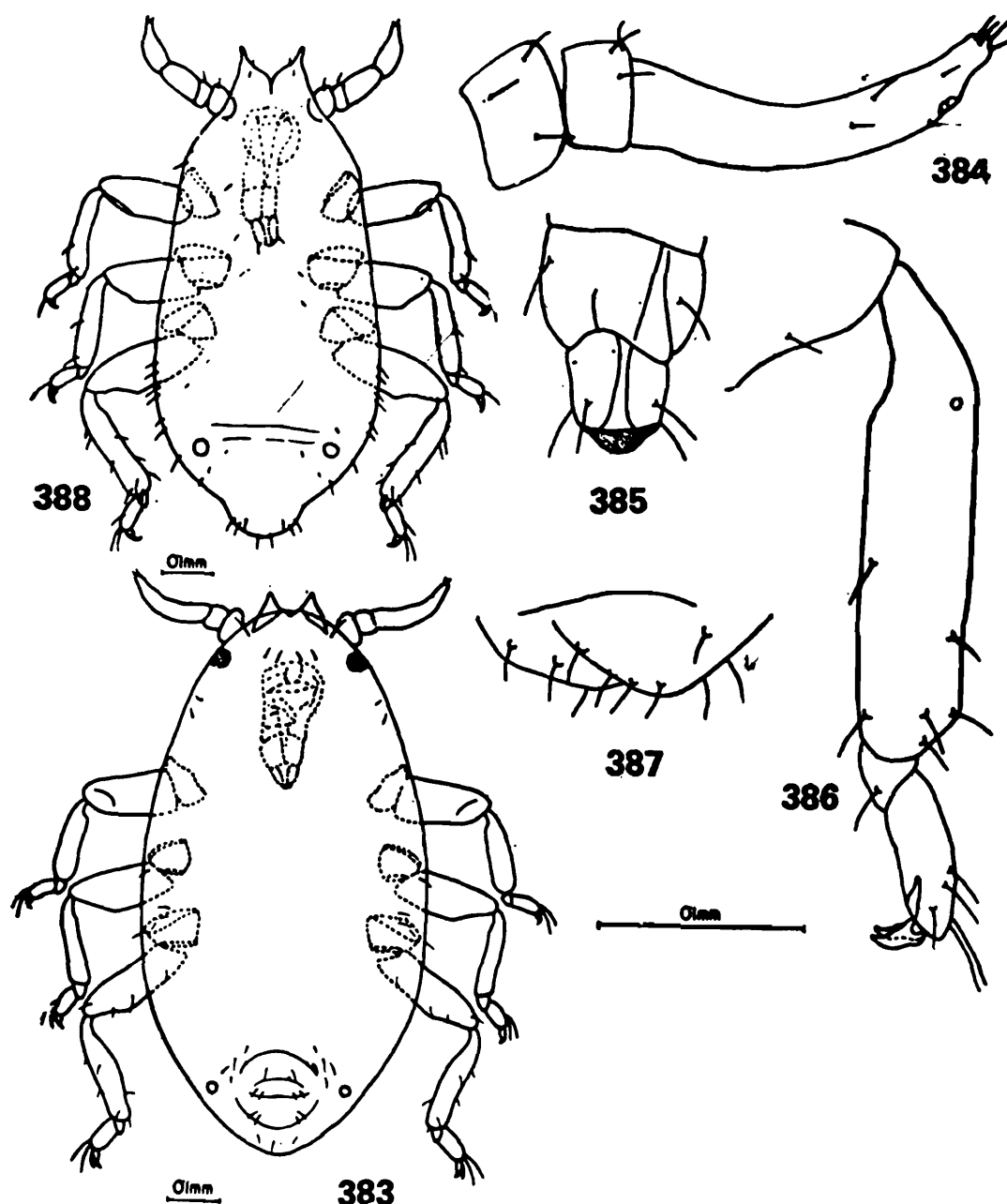
(1, ex *Populus*, Srinagar, India, 30.vii. 1980, BMNH ; 2 & 3, ex *Populus*. Toyama, Japan, 4.v.1957, Hokkaido Univ.).



Doraphispopuli (Maskell). Apterous exule : 378, whole body ; 379, antenna ; 380, ultimate rostral segment ; 381, hind leg ; 382, caudal region.

Alate viviparous female : Body 1.4-1.5 mm long with 0.70-0.72 mm as maximum width. Head dark brown with paired, very small,

frontal prominences ; dorsal cephalic hairs sparse, minute. Antennae 4-segmented, $0.28-0.30\times$ as long as the body ; antennal hairs hardly discernible ; segment III with 17-23 annular secondary rhinaria, segment IV with 12-13 similar rhinaria distributed over entire length ; processus terminalis very small, less than $0.16\times$ long as the base of last antennal segment. Eyes large with distinct ocular tubercles. Rostrum reaches beyond forecoxae, ultimate rostral tubercles. Rostrum reaches beyond forecoxae, ultimate rostral



Apterous viviparous female : 383, whole body ; 384, antenna ; 385, ultimate rostral segment ; 386, hind leg ; 387, caudal region ; Apterous nymph : 388, whole body.

segment parallel/sided, $0.55-0.66 \times$ as long as second segment of hindtarsus and without any accessory hairs. Abdominal dorsum pale ; spiracles present ; dorsal hairs fine, minute. Siphunculi poriform with thick sclerotic rims. Cauda semioval, broader than long, constricted at base and bearing about 9-10 hairs. Subgenital plate scrabrous, with 17-20 hairs. Gonapophyses 2-each with 7-8 small hairs. Subanal plate bilobed, each lobe with 6-8 long fine hairs. Legs normal, except trochanters which are fused with femora ; tarsi 2-segmented, claws normal ; first tarsal segments with 2,2,2 (?) hairs. Forewings with media simple, anal and cubitas fused at base for considerable length ; hindwings with one oblique.

Colour : Not recorded.

Measurements in mm. :

	Length	Width	Antenna
1.	1.51	0.72	0.45
2.	1.48	0.70	0.43
	Antennal segments		
	III IV	urs	ht ₂
0.21	(0.13+0.02)	0.05	0.09
0.21	(0.13+0.02)	0.06	0.09

(1, 2, ex *Populus* sp. Osaka, Japan, 8.vii.1956, Hokk. Univ.).

Nymph : (*Apterous aliencolae*) : Body 0.73 mm long with 0.42 mm as maximum width, pale, crenulated along the entire margin. Antennae 2-segmented, 0.043 mm long, thick and rounded at apex, Prosoma distinctly indented at the middle of frons. Rostrum short reaching near midcoxae, ultimate rostral segment 0.036 mm long, thick, squarish. Dorsal hairs not discernible. Siphunculi absent. 8th tergite separated from rest of body, rounded caudad. Fore- and mid-legs without tarsi ; hind-legs with 2-segmented tarsi, without claws.

Colour : Pale in life.

Measurements in mm. :

Length	Width	Antenna	u.r.s.
0.73	0.42	0.04	0.036

(ex. *Populus* sp., Osaka, Japan, 8.vii. 1956, Hokkaido University).

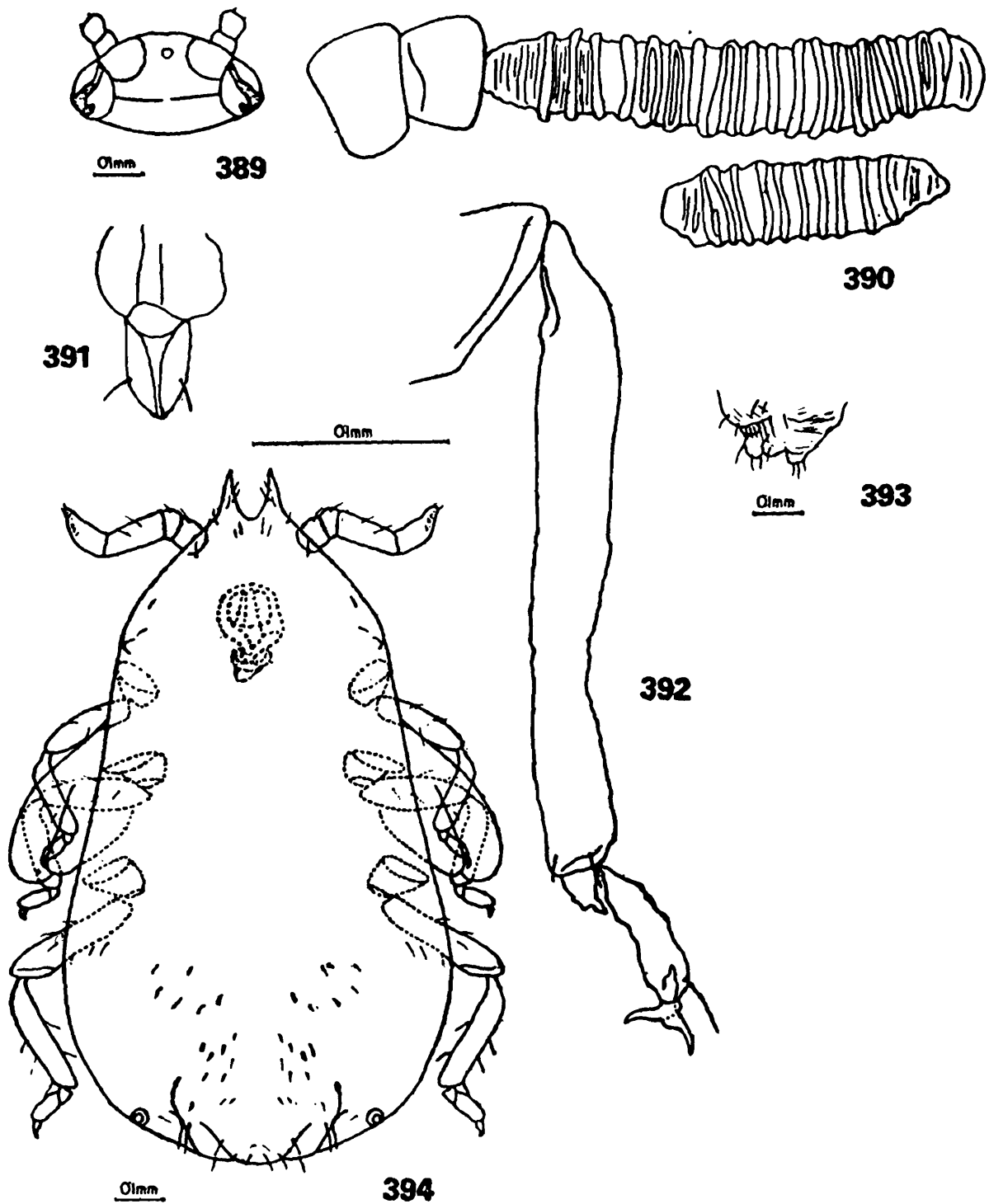
Nymph (Alate viviparous female) : Early stage of nymphs without wing pads but with distinct pair of frontal horns (0.053 mm) which are pointed at apices and fused at base. Frontal horns gradually becoming shorter at late stages of nymphs and after attaining maximum length of 0.083 mm, almost disappears in adult alate. Frontal horns with 2-3 hairs, upto 0.010-0.013 mm long. Antennae thick, dusky, 3-4-segmented ; primary rhinaria rounded. Ultimate rostral segment broader than long, with 2 pair of pre-apicals. Dorsum of abdomen pale. Hairs on the dorsum of abdomen fine, 0.06-0.03 mm long ; marginal hairs longer, upto 0.03 mm long. Siphunculi poriform. Legs stout, trochanters fused with femora ; tarsi 2-segmented, claws normal ; first tarsal segments with 3, 2, 2 hairs ; dorso-apical hairs on second tarsal segments, flattened at apices ; empodial hairs fine, longer than claws.

Colour : Not recorded.

Measurements in mm. :

	Length	Width	Antenna	
1.	1.10	0.48	0.27	
2.	1.79	0.82	0.35	
	Antennal segments			
	I	II	III	
	0.05	0.036	0.181	0.053
	0.05	0.040	0.265	0.056
				0.083
				0.090

(1, ex *Populus* sp., Manali, India, 18.v.1969, BMNH ; 2. ex. *Populus* sp., Osaka, Japan, 8.vii.1969, Hokkaido University)



Alate viviparous female : 389, head ; 390, antenna ; 391, ultimate rostral segment ; 392, hind leg ; 393, caudal region ; Alate nymph : 394, whole body.

Material examined : Seven alatoid nymphs from *Populus* sp., Manali, India, 18.v.1969, Coll. K. Narayanan (1009), BN 1971.428; Two apterous aliencolae, from *Populus* sp., Srinagar, J. & K. States,

India, (CIEA 12612, BH 553/80, BMNH collections) ; 16 apterous aliencolae and one nymph from *Populus* Nagano, Osaka, Prof. Japan, 3.v.1959, Toyama, Japan, 4.v.1959, Mt. Rokke near Kobe, Japan, 2.vi.1956 (R. Takahashi Collections, Hokkaido Univ., Japan) ; 4 alate viviparous females and 8 alatoid nymphs from *Populus sieboldiana*, Osaka-fu, Japan, 8.vii.1956, Coll. M. Sorin, det. R. Takahashi (R. Takahashi Collection, Hokkaido Univ., Japan).

Discussion : The collections from Poplars in Northwest India and Kashmir indicate possibility of its wider distribution in the Poplar growing area of the country. The records of infestations as can be evidenced from Indian collections and extensive material from Japan indicate its occurrence during the months of May—July.

Distribution : India ; Himachal Pradesh, Kashmir ; Japan : Korea.

Types : Location of types not known.

Genus 23. *Glyphinaphis* van der Goot, 1917

1917. *Glyphinaphis* van der Goot, P. *Contrib Faune Indis Neerl.*, 1 (3) : 232 ; Baker, A.C., 1921. *Bull. U.S. Dep. Agric.*, 826 : 85 ; Raychaudhuri, D.N., Ghosh, M.R., Pal, K.P. & Ghosh, A.K., 1980. *In* Aphids of North East India and Bhutan, 375. Type species : *Glyphinaphis bambusae* van der Goot.

Morphology : Body oval to elongated oval. Head in apterae fused with prothorax, with wax plates. Antennae 4-segmented in apterae, 5-segmented in alatae, always less than half the length of body ; secondary rhinaria in alatae present on segments III and IV, annular, non-ciliated ; primary rhinaria protruberant, non-ciliated. Eyes of 3 facets in apterae, normal in alatae. Rostrum short, hardly reaching mid-coxae, ultimate rostral segment blunt, shorter than second segment of hind tarsus and without any accessory hairs. Dorsal hairs long, thick, conspicuous. Abdominal dorsum sclerotic, with indistinct segmentation upto 7th tergite. Wax plates cribiform. Abdominal tergites each 7th and 8th with 6 hairs. Siphunculi poriform. Cauda pentagonal with 8-10 long hairs. Subanal plate bilobed. Subgenital platea little in-pushed medially, with

11-18 long hairs. Legs with trochanters fused with femora ; dorso-apical hairs on second tarsal segments funnel-shaped at apices ; empodial hairs similar to dorso-apical hairs, longer than claws; first tarsal segments with 4, 4, 2 hairs. Forewing with media once branched ; hindwings with both obliques.

Discussion : The genus is monotypic with one species *bambusae* van der Goot, originally described from Java and subsequently recorded from China, Malaya and India, always restricted to Bamboo and reedgrass. Detailed life-history and morphology of immature form have never been reported. The Indian specimens exhibit great deal of variations in the ratio of length of dorsal hairs to basal diameter of antennal segment III.

Biology : The only member of this genus appears anholocyclic, monoecious on Bamboo and reed-grass. Detailed biology and phenology of the member of this genus remain unknown. No natural enemy has been reported so far. Myrmecophily is not recorded.

Distribution : India ; Java ; Malaysia ; China.

Type species : *Glyphinaphis bambusae* van der Goot, 1917. Location of types not known.

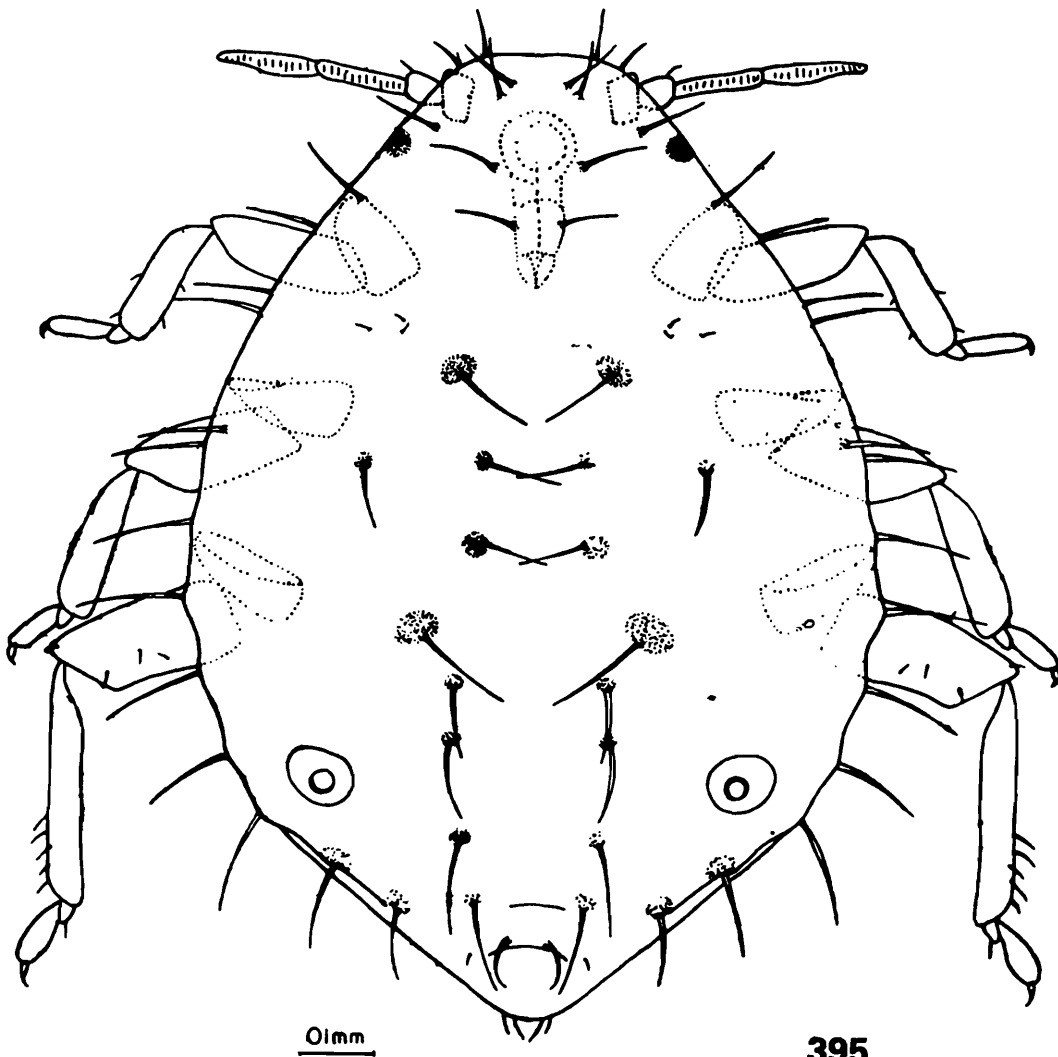
57. *Glyphinaphis bambusae* van der Goot (Figs. 395-401)

1917. *Glyphinaphis bambusae* van der Goot, P., *Contr. Faune Indes. neerl.*, 1 (3) : 232.

1980. *Glyphinaphis bambusae*, Raychaudhuri, D.N., Ghosh, M.R., Pal, P.K., & Ghosh, A.K.. *In Aphids of North East India and Bhutan*, 375.

Apterous viviparous female : Body 1.3-2.0 mm long with 1.0-1.10 mm as maximum width. Head brown to dark brown with small group of circular wax pores ; hairs on the dorsum of head thick, stout with blunt to flagellate apices, rarely furcated, $2.40-11.5\times$ as long as the basal diameter of antennal segment III. Antennae 4-segmented, pale brown to dark brown, $0.14-0.25\times$ as long as the body ; flagellum feebly imbricated ; antennal hairs fine, 1-2 on each of basal segments, one placed near apical 0.25 portion on inner margin of segment III, these being upto 0.026-0.030 mm long on

segment II and 0.016-0.026 mm long on III, and $1.30-1.60\times$ and $0.60-1.40\times$ as long as basal diameter of antennal segment III, respectively ; processus terminalis $0.15-0.35\times$ as long as base of last antennal segment. Eyes of 3 facets. Rostrum reaches mid-coxae, ultimate rostral segment blunt, $0.55-0.80\times$ as long as second segment of hind tarsus and without any accessory hairs. Thoracic segments each with duplicated marginal hairs and paired spinal hairs. Abdo-



Glyphinaphis bambusae v. d. Goot. Apterous viviparous female : 395, whole body.

minal dorsum brown bearing paired marginal cribriform wax plates ; hairs on the dorsum of abdomen thick, stout, 4-6 per segment, arranged in paired spinal, pleural and marginal pair ; 6th and 7th tergites each with only 4 hairs and 8th tergite with only two hairs ;

hairs on anterior tergites $1.20-10.50 \times (0.030-0.26)$ on 7th tergite $2.2-12.50 \times$ and on 8th tergite $3.2-9.3 \times$ as long as the basal diameter of antennal segment III, respectively. Siphunculi ring-like, without any whorl of hairs. Cauda brown, pentagonal bearing a pair of long fine apical hairs besides 2-4 other basal hairs. Subanal plate bilobed, each lobe bearing at least 6-7 fine hairs, of which one is decidedly much longer and thicker than the others. Subgenital plate brown, medially inpused, with 8-10 fine hairs ; gonapophyses 2, each with 5-6 hairs. Legs stout, brown, trochanters fused with femora ; hairs on tibiae sparse (7-11), short, acute, on hind tibiae 0.013-0.020 mm long, always less than half in length than the diameter at the middle of hind tibia ; first tarsal segments with 4, 4, 2 hairs ; dorso-apical hairs on second tarsal segment expanded at apices ; empodial hairs expanded at apices and longer than claws.

Colour : Brownish in life.

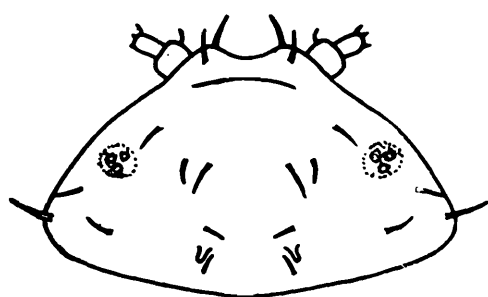
Measurements in mm. :

	Length	Width	Antenna	
1.	1.79	1.03	0.29	
2.	1.88	1.07	0.32	
3.	1.68	1.04	0.32	
	Antennal segments		urs.	ht ₂
	III	IV		
0.103	(0.076+0.020)		0.05	0.08
0.103	(0.080+0.020)		0.05	0.08
0.106	(0.076+0.026)		0.06	0.08

(1, 2, 3 ex Bamboo, Kalimpong, 26.xii.1969, C.U.).

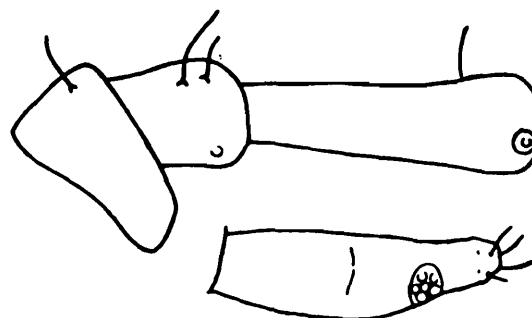
Alate viviparous females : (from Pal, 1975). Body 1.9 mm long with 1.08 mm as maximum width. Head not fused with pronotum; cephalic hairs arranged in groups near base of antennae. Antennae 4-segmented, $0.42 \times$ as long as the body ; flagellum imbricated ; segment III with 31 and IV with 14 subannular secondary rhinaria ; hairs on flagellum fine, longest one about 0.010 mm long;

processus terminalis $0.10\times$ as long as base of last antennal segment. Abdominal dorsum pale brown ; hairs on anterior tergites short and stout with blunt apices ; 7th tergite with a marginal pair of hairs arising from chitinized bases besides spinal hairs ; 8th tergite with 7 long and stout hairs. Cauda with longer hairs on the margins besides other short hairs. Forewings with media once branched and hindwings with two oblique veins. Other characters as in apterae.

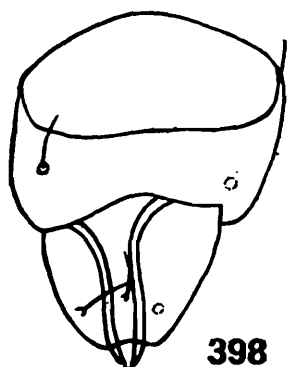


396

01mm



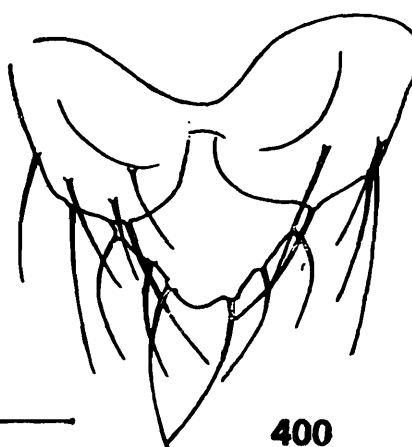
397



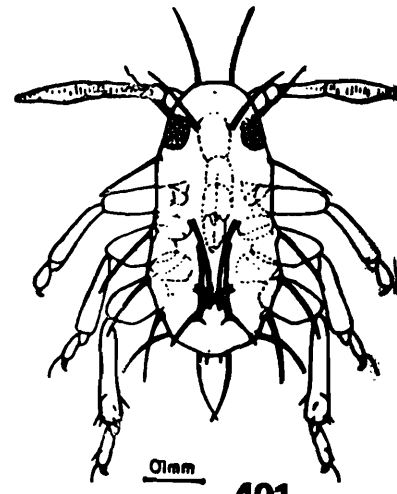
398



399



400



401

Apterous viviparous female :

396, head ; 397, antenna ; 398, ultimate rostral segment ; 399, hind tarsus ; 400, caudal region ; Apterous nymph : 401, whole body.

Colour : Not recorded.

Measurements in mm. :

Length
1.92

Width
1.08

Antenna
0.83

Antennal segments		urs.	ht ₂
III	IV		
0.49	(0.22+0.02)	0.06	0.09

Nymph : Body broad, oval 1.10-1.16 mm with 0.79-0.82 mm as maximum width. Head brownish ; hairs on the head finer than other dorsal hairs, placed on 1-2-2 sequence from frons to pronotum on each side ; besides a centrally placed pair of spinal hairs, at the junction of head with pronotum, these hairs being 0.052-0.065 mm long ; Antennae 4-segmented, 0.24× as long as the body ; hairs on flagellum sparse, fine, 1.0-1.1× as long as basal diameter of antennal segment III. Abdominal dorsum pale ; 1st-7th tergite, each with a marginal hair on each side, besides paired spinal hairs ; 1st, 2nd and 4th tergite with also an additional pair of hairs, placed more pleurally ; spinal hairs on 3rd tergite distinctly displaced away from others ; 8th tergite with 2 hairs ; hairs on anterior tergites 0.091-0.136 mm long, those on 8th tergite upto 0.078 mm long, these being 4.3-8.0× and 4.1-4.2× as long as the basal diameter of antennal segments III, respectively. All dorsal hairs arise from dark brown broad, sclerotic bases. Siphunculi on small sclerotic cones. Subanal plate with 5-6 hairs. Subgenital plate with about 8 hairs. Legs stout, stumpy ; hairs on tibiae fine, mostly arranged in a row along the margin on apical half ; first tarsal segments with 4, 4, 2 hairs.

Colour : Not recorded.

Measurements in mm. :

	Length	Width	Antenna
1.	1.10	0.79	0.26
2.	1.16	0.82	0.28

Antennal segments		urs.	ht ₂
III	IV		
0.10	(0.07+0.04)	0.05	0.09
0.08	(0.08+0.03)	0.05	0.08

(1, 2, ex Bamboo sp., Shillong, 30.vi.1977, Z.S.I.).

Material examined : 9 apterous viviparous females from Bamboo, Kalimpong, Darjeeling district, West Bengal, 26.xii.1969, (C. U. PLK 823) ; 4-apterous viviparous female and two nymphs from Bamboo, Shililong, Meghalaya, 30.vi.1977, coll. K. Deb (ZSI/ERS 1224).

Discussion : These insects usually infest tender shoots of Bamboo and *Thysanolaena maxima* and form large colonies. White waxy secretion may be noted in the colonies which are often attended by ants. Apterous generations appear to be much more predominant and alatae are found rather sparsely, only during winter in the hills.

Raychaudhuri *et al.* (1980) noted great variations in the ratio of length of longest hair on 1st, 7th, 8th tergite to basal diameter of antennal segment III and extensive collections from Indian region can be grouped into 3 to 4 categories but has been treated under one species for the present.

Distribution : India; Arunachal; Manipur; Meghalaya, Sikkim; West Bengal ; Indonesia.

Types : Location of types not known.

Genus 24. *Pseudoastegopteryx* Ghosh, Pal & Raychaudhuri, 1974

1974. *Pseudoastegopteryx* Ghosh, M.R., Pal, P. K. & Raychaudhuri, D. N., *Proc. zool. Soc. Calcutta*, 27 : 109 ; Raychaudhuri, D.N., Ghosh, M.R., Pal, P.K. & Ghosh, A.K., 1980. In *Aphids of North East India, and Bhutan*, 389. Type species : *Pseudoastegopteryx himalayensis* Ghosh, Pal & Raychaudhuri.

Morphology : Body pale, pear-shaped in apterae. Head and pronotum fused in apterae ; head with a pair of well developed frontal horns, rounded at apices and each bearing 8-12 short hairs. Antennae 4-5-segmented, always less than half the length of body; primary rhinaria round, protuberant, ciliated ; secondary rhinaria subannular, distributed over the entire flagellum. Eyes of 3 facets in apterae, normal in alatae. Rostrum hardly reaches mid-coxae, ultimate rostral segment blunt, shorter than second segment of hind tarsus, without any accessory hairs. Dorsum pale with faint

hair-bearing sclerites in apterae, without any wax glands or pores. Dorsal hairs long, fine ; 8th tergite with 5-6 hairs. Siphunculi on pale and distinctly elevated, truncated, hair bearing cones. Cauda pale, slightly oval with 8-12 hairs. Subanal plate with 16-22 hairs. Legs with trochanters fused with femora ; first tarsal segments with 3, 3, 2 hairs, sometimes apterae with 3, 2, 2 hairs, dorso-apical hairs on second tarsal segments flattened at apices; empodial hairs flattened at apices, longer than claws. Forewings with media once branched, pterostigma short, cubitus and anal united at base, hindwings with both obliques. Embryos of typical *Astegopteryx* type with full compliments of marginal wax glands.

Discussion : This is a monotypic genus based on a species so far known only from Darjeeling district in West Bengal, India ; long series of collections made over different seasons during 1969, 1970 and 1971, exhibit conformity in the characters of absence of wax glands or pores in adults. In all other characters, the present genus resembles *Astegopteryx*. The consistent absence of wax glands in adults but presence of full complement of marginal wax glands in embryos, makes the genus distinctive from related ones.

Biology : The type-species, *himalayensis*, infests unidentified bamboos, specially on the undersurface of leaves, mostly during February-May and again in September-October. Ants sometime, visit these insects in the colonies.

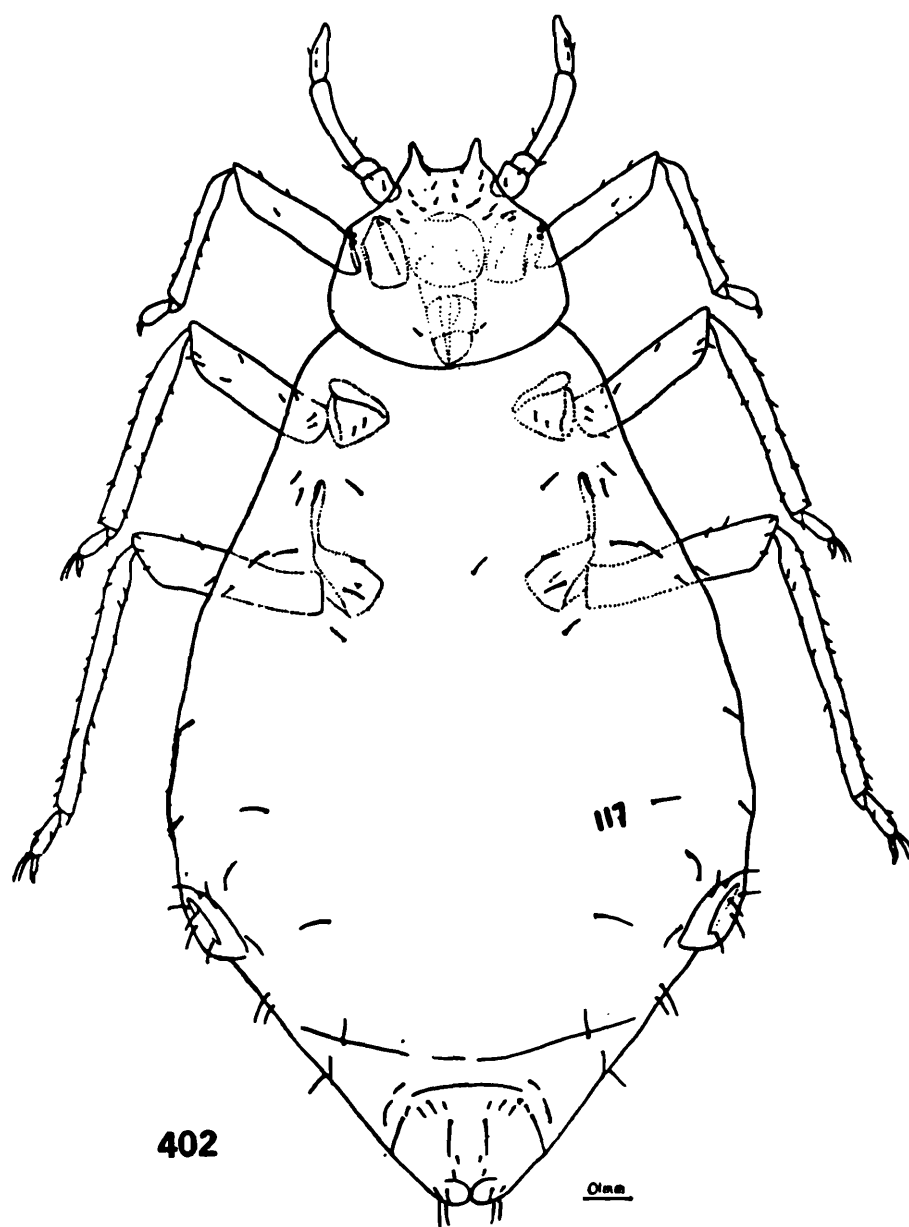
Distribution : India, West Bengal.

Type species : *Pseudoastegopteryx himalayensis* Ghosh, Pal and Raychaudhuri. In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India.

58. *Pseudoastegopteryx himalayensis* Ghosh, Pal and Raychaudhuri
(Figs. 402-408)

1974. *Pseudoastegopteryx himalayensis* Ghosh, M.R., Pal, P.K. and Raychaudhuri, D.N., *Proc. zool. Soc. Calcutta*, 27 : 109.
1980. *Pseudoastegopteryx himalayensis*, Raychaudhuri, D.N., Ghosh, M.R., Pal, P.K. and Ghosh, A.K., *In Aphids of North East India and Bhutan*, 389.

Apterous viviparous female : Body 1.71-2.10 mm long with 0.95-1.30 mm as maximum width. Head fused with prothorax, dusky on anterior portion and bears a pair of frontal horns with rounded tips, $1.0-1.1\times$ as long as antennal segment II ; hairs on cephalothorax fine, 0.040-0.050 mm long, upto $1.50-2.0\times$ as long as the basal diameter of antennal segment III. Antennae 4-segmented, $0.20\times$ as long as the body, rarely 5-segmented, then $0.23-0.30\times$ as long as the body ; flagellum faintly imbricated ; hairs on antennae sparse, longest one on segment III 0.023-0.033 mm long, upto 0.80-



Pseudoastegopteryx himalayensis Ghosh, Pal and Raychaudhuri, Apterous viviparous female : 402, whole body,

1.2 $\times$ as long as the basal diameter of the segment ; processus terminalis 0.18-0.20 $\times$ as long as base of last antennal segment. Rostrum hardly reaches midcoxae ; ultimate rostral segment 0.57-0.75 $\times$ as long as second segment of hind tarsus. Abdominal dorsum pale, with dusky, marginal, hair-bearing sclerites ; hairs on the dorsum of abdomen fine, not more than 10 on 1st-6th tergites ; 7th and 8th tergites each with 6 hairs ; hairs on anterior tergites 0.066-0.073 mm long, 2.1-3.0 $\times$ as long as basal diameter of antennal segment III and on posterior tergites 0.083-0.090 mm long, 2.5-3.0 $\times$ as long as the mentioned diameter. Wax glands not evident. Siphunculi on pale elevated cones bearing long, fine hairs. Cauda pale, transversely oval, with 8-12 hairs. Subanal plate bilobed, each lobe with 9-11 hairs. Legs smooth ; hairs on femora and tibiae fine, longest hair on hind tibiae 0.026 mm long, 0.66 $\times$ as long as the diameter at the middle of the hind tibia ; first tarsal segments with 3, 3, 2 hairs, rarely with 3, 2, 2 hairs ; dorso-apical hairs on second tarsal segment and empodial hair longer than claws, with flattened apices.

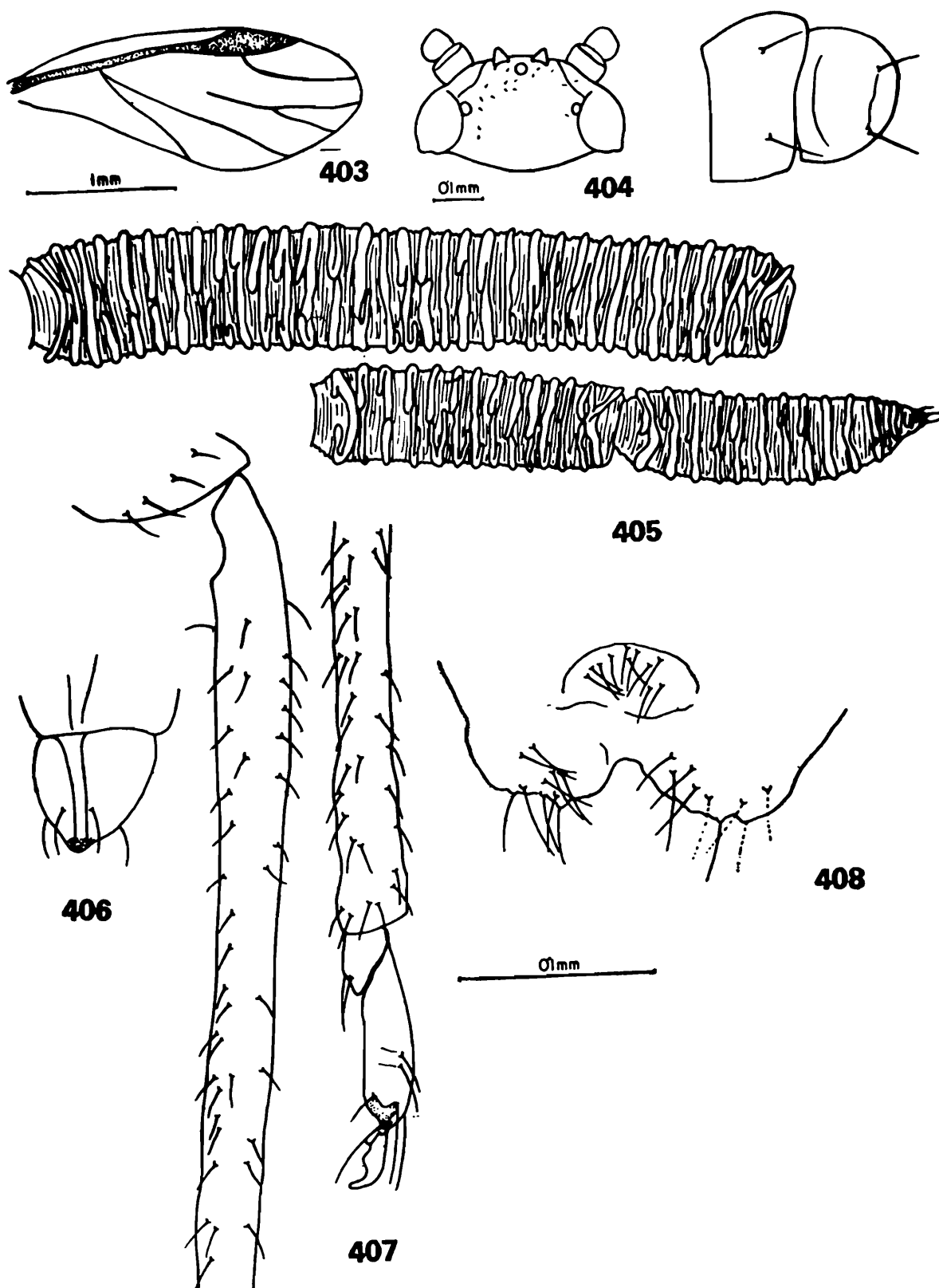
Colour : Yellow to pale green.

Measurements in mm. :

	Length	Width	Antenna	
1.	2.10	1.17	0.41	
2.	1.80	1.05	0.40	
3.	1.82	1.14	0.47	
	Antennal segments		urs	ht ₂
III	IV	V		
0.20	(0.10+0.02)	—	0.07	0.09
0.20	(0.10+0.02)	—	0.07	0.10
0.15	0.08	(0.10+0.01)	0.07	0.11

(1, ex Bamboo, Kameshi, W.B., 5.iv.1971, C.U. ; 2, 3, ex. Bamboo, Kalimpong, 3.iv.1971 C.U.).

Alate viviparous female : Body 2.05-2.5 mm long with 1.0-1.20 mm as maximum width. Head with frontal horns short, conical, blunt at apex, 0.45 $\times$ as long as antennal segment II ; cephalic



Alate viviparous female : 403, forewing ; 404, head ; 405, antenna ; 406, ultimate rostral segment ; 407, part of hind leg ; 408, caudal region.

hairs fine, 0.010-0.020 mm long, upto $0.60-0.75\times$ as long as basal diameter of antennal segment III. Antennae 5-segmented, $0.38-0.43\times$ as long as the body, pale brown ; flagellum with distinct spinulose imbrications, segment III with 32-36, IV with 12-13, V with 11-12 annular secondary rhinaria ; hairs on flagellum sparse, minute, upto $0.18\times$ as long as the basal diameter of antennal segment III ; processus terminalis $0.20\times$ as long as base of last antennal segment. Rostrum reaches beyond forecoxae, ultimate rostral segment $0.60-0.63\times$ as long as second segment of hind tarsus. Abdominal dorsum pale, without apparent marginal sclerites ; hairs on the dorsum of abdomen fine, 0.033-0.040 mm long, $1.0-1.20\times$ as long as the basal diameter of antennal segment III ; 8th tergite with 6 hairs, upto 0.040-0.050 mm long, $1.1-1.5\times$ as long as the mentioned diameter. Siphunculi on cones bearing 13-21 hairs. Cauda with 11-14 hairs. Subanal plate with 10-11 hairs on each lobe. Legs pale brown, smooth ; hairs on femora and tibiae short, fine, longest one on hind tibiae 0.020 mm long, $0.50\times$ as long as the diameter of the middle of the hind tibia. Forewings with media once branched ; cubitus and anal united at base ; hindwings with both obliques.

Colour : Brownish in life.

Measurements in mm. :

	Length	Width	Antenna	
1.	2.51	1.10	1.0	
2.	2.21	1.10	0.84	
3.	2.32	1.05	0.89	
	Antennal segments			
III	IV	V	urs	ht ₂
0.48	0.19	(0.15+0.13)	0.07	0.10
0.43	0.15	(0.14+0.03)	0.07	0.10
0.43	0.18	(0.14+0.03)	0.07	0.10

(1, 2, 3, ex Bamboo, Kameshi, West Bengal, 5.iv.1971, C.U.).

Other morphs : Not known.

Material examined : Many aptera and alate viviparous females from unidentified Bamboo, Takdah, 31.v.1969, Kameshi, Kalimpong, ii-1970 to x-1971, Mongpoo, West Bengal, 1.x.1970, 9.ii.1971, 4.iv.1971, Colls. M. R. Ghosh (C.U.).

Discussion : The species is so far known only from North-East India and has been observed to form colonies on undersurface of leaves of *Bambusa arundinacea* and other Bamboo species. The colonies remain covered with scanty powdery secretion. The available records indicate its occurrence between the months of September to May. Attendance by ant is not uncommon.

Distribution : India : West Bengal, Sikkim, Nagaland, Manipur.

Types : In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India.

Genus 25. *Pseudoregma* Doncaster, 1966

- 1966. *Pseudoregma* Doncaster, J.P., *Entomologist*, **99** : 159 ; Ghosh, M.R., Pal, P.K. & Raychaudhuri, D.N., 1974. *Proc. zool. Soc. Calcutta*, **27** : 112 ; Raychaudhuri, D.N., Ghosh, M.R., Pal, P.K. & Ghosh, A.K., 1980. *In Aphids of North East India and Bhutan*, 390. Type species : *Pseudoregma bucktoni* Doncaster (new name proposed by Ghosh, M.R., et al., 1974 for *Pseudoregma bambusicola* Takahashi) *sensu* Doncaster, 1966.
- 1974. *Neoceratovacuna* Ghosh, M.R., Pal, P.K. & Raychaudhuri, D.N., *Proc. zool. Soc. Calcutta*, **27** : 102 ; Raychaudhuri, D.N., Ghosh, M.R., Pal, P.K. & Ghosh, A.K., 1980. *In Aphids of North East India and Bhutan*, 380. Type species : *Oregma panicola* (= *panicicola*) Takahashi, N. Syn.
- 1974. *Paraoregma* Ghosh, M.R., Pal, P.K. & Raychaudhuri, D.N. *Proc. zool. Soc. Calcutta*, **27** : 105 ; Raychaudhuri, D.N., Ghosh, M.R., Pal, P.K., & Ghosh, A.K., 1980. *In Aphids of North East India and Bhutan*, 388. Type species : *Oregma alexandri* Takahashi, N. Syn.
- 1982. *Indoregma* Chakrabarti, S. and Maity, S.P., *Proc. zool. Soc. Calcutta*, **33** : 59. Type species : *Indoregma bumbusae* Chakrabarti & Pal, N. Syn.

Morphology : Body pale to brown. Head fused with prothorax, with numerous scattered wax pores ; in apterae, with a pair of small or long, blunt to conical horns ; pronotum with two pleural grooves, separating a posterior ridge, dorsal cephalic hairs long and fine. Antennae 4-5-segmented in apterae, 5-segmented in

alatae, hardly $0.50\times$ as long as the body ; primary rhinaria round, little protruberant, oval, ciliated ; secondary rhinaria in alatae annular, usually on all segments of flagellum ; processus terminalis always much shorter than length of base of last segment. Eyes of 3 facets in apterae, normal in alatae. Rostrum reaches at most mid-coxae ; ultimate rostral segment short, blunt, usually without any accessory hairs. Meso- and Meta-thoracic segments usually with paired marginal sclerites bearing wax pores or appearing pitted and with paired spinal sclerites. Abdominal dorsum with paired marginal and spinal sclerites variably developed and or with marginal wax pores ; abdominal dorsum may also have full compliment of wax glands (spinal, pleural, marginal) or variably developed wax gland on marginal and spinal areas ; 8th tergite in apterae with wax pores or spino-pleural wax gland cells, arranged in a group ; alatae usually with sclerotic transverse band on posterior tergites. Siphunculi pore-like on sclerotic cones, which are usually devoid of hairs. Cauda with basal constriction and with many hairs. Subanal plate bilobed. Legs long, dark brown ; trochanters fused with femora ; first tarsal segments with 4, 3, 2 or 4, 4, 2 hairs ; empodial hairs with blunt or funnel-shaped apices, much shorter than ($0.30\times$) to slightly longer than claws ; both dorso-apical hairs on second tarsal segment may be with funnel-shaped apices (cf. *bucktonis*, *panicola*) or one may be slightly club-shaped and other, short and blunt (cf. *alexandri*). Forewings with media once branched ; cubitus and anal fused at base, sometimes inner margin of subcosta pale.

Sexual forms are unknown. Larvae may be pseudoscorpion-like with heavy forelegs, immobile foretarsi, very large horns and claws are normal and have variable wax glands or pores.

Discussion : The genus *Pseudoregema* was erected by Doncaster (1966) to accommodate part of the type material of *Oregma bambusae* Buckton, which on examination revealed two species, one resembling *Astegopteryx lutescens* v.d. Goot, has been transferred to *Astegopteryx* as *A. bambusae* (Buckton), while for the other, the name, *Oregma bambusicola* Takahashi was used as "*bambusicola* Takahashi 1921 would seem to refer to the same species and is available" (Doncaster, 1966). It is not clear from Doncaster (op. cit) whether he has actually examined the type

material of *bambusicola* Tak., before concluding that the part of the material of *bambusae* Buckton really belongs to *bambusicola* Tak., or otherwise. Ghosh, M. R. *et al.* (1974) reported, that on examination of material of *bambusicola* Tak., (determined by Takahashi), it became apparent that *bambusicola*, *sensu* Takahashi, is a completely different species from the one described by Doncaster (op. cit) under the same name on the basis of part of Buckton's specimens and suggested a new name *bucktoni* to accommodate the latter. Ghosh, M. R. *et al.* (1974), however, added that while *bucktoni* should replace *bambusicola* as type species of *Pseudoregma*, the latter should still be included under the same genus, as a distinct species.

Eastop and Hille Ris Lambers (1976) listed 11 species under *Pseudoregma* Doncaster. Ghosh, M. R. *et al.* (1974), however, created two new genera to accommodate two of these 11 species, viz., the genus *Neoceratovacuna* was erected with *Pseudoregma panicola* (= *panicicola*) Tak. as the type species, largely because of presence of wax gland groups on posterior part of the body and funnel-shaped apices of two dorso-apical hairs on second tarsal segments; the genus *Paraoregma* was erected with *Pseudoregma alexanderi* (Takahashi) as type species, having distinct wax glands on 8th tergite as in *Neoceratovacuna* but with dorso-apical hairs similar to typical *Pseudoregma*. These two new monotypic genera erected largely on the basis of presence of distinct wax glands and apices of dorso-apical hairs, were reexamined, specially in view of the fact that several other species listed under *Pseudoregma* Doncaster by Eastop and Hille Ris Lambers (1976) also exhibit variably distributed, but well developed wax gland cells (e. g. *dendrocalami* (Tak.), *gombokana* (Tak.), *koshuensis* (Tak.), *nicolaiæ* (Tak.), *pendleburyi* (Tak)). As such, both the monotypic genera are treated here as synonyms of *Pseudoregma*. Chakrabarti and Maity (1982) described another new genus *Indoregma* from Dehra Dun, Uttar Pradesh and mentioned that in having full complement of wax gland groups and 3-faceted eyes, the genus comes close to *Ceratovacuna* Zehnt, and *Paraoregma* Ghosh M. R. *et al.*, (the latter being considered here as a complete synonym of *Pseudoregma* Doncaster). Paratype-material of type species of the genus *Indoregma bambusae* made available for the present study clearly indicates that this monotypic genus should also be

regarded as yet another synonym of *Pseudoregma*, with typical denticles, prothoracic lobes, ill-formed wax gland groups on variably developed sclerites etc., the full compliment of wax gland, was, however, not evidenced in any of the 6 paratypes. Further, *bambusae* Chakrabarti & Maity is considered here as a synonym of *P. panicola* (Takahashi), in view of above observations.

In the region, a total of 4 species are known to occur, viz., *alexandri* (Takahashi), *bucktoni* (Ghosh, *et al.*), *orientalis* (Agarwala *et al.*) and *panicola* (Takahashi), mostly from bamboo-growing regions of northeastern India. Including the new name *bucktoni* suggested for part of Buckton's material, and recently described *orientalis*, the total number of species of *Pseudoregma* stands at 13.

Biology : All the species of the genus appear to have anholo-cyclic, monoecious life-cycle. The host-plants include *Arundanaria*, *Bambusa* (*nana*, *chinensis*, *stenostachya* etc.), *Eleusine* (e.g. *aristater*), *Dandrocalthamus flagellifer*, *Flattaria cardamomina*, *Niolaia speciosa*, *Panicum* (e.g. *padens*), *Setaria* (e.g. *macrostachya*) and *Pseudoechinolaena polystachya*, besides other unidentified Bamboo, in South-East Asia. Most of the species form dense colonies on undersurface of leaves near basal part, sometimes on young shoot and stalk (e.g. *dendrocalami*) and are known by both apterous and alate viviparae ; period of infestation largely extends in between October-February in temperate condition, sometimes also during May-July (e.g. *koshuensis* in Sumatra). None of the species has been described with all nymphal instars, but wherever normal young nymphs are known, they exhibit similar characters to adults, except that frontal horns may be more elongate or pointed ; Aoki *et al.* (1981) studied in details the life-cycle of *P. alexanderi* in Formosa, (see *alexandri*), and observed that the species can reproduce parthenogenetically throughout the year on *Dendrocalamus* ; nymph of *P. kosshuensis* (Tak.) is reported to have cauda without constriction and undivided anal plate.

No parasites are known from any species of *Pseudoregma*. Myrmecophaly is occasional.

Distribution : India ; China ; Thailand ; Malayasia ; Sumatra ; Java ; Australia ; New Zealand ; Africa ; Cuba.

Type species : *Pseudoregma bucktoni* Doncaster (*Oregma bambusae* Buckton, *partim*) ; Holotype and Paratypes deposited in the collections of British Museum (Nat. Hist), London and part of paratypes deposited in National Zoological collections, Zoological Survey of India, Calcutta, India.

Key to the species of *Pseudoregma* Doncaster

Apterous viviparous females :

1. Distinct wax gland cell groups absent. Head and body with numerous small wax pores, those on abdomen grouped in marginal and spino-pleural sclerotic region. Frontal horns short, bluntly conical. Ultimate rostral segment upto $0.75 \times$ as long as second segment of hind tarsus

P. bucktoni Ghosh, Pal
and Raychaudhuri

Distinct wax gland cell groups always present but variably distributed over body. Frontal horns short, rounded or long and slender

2

2. Wax gland groups present on cephalothorax and abdomen, (marginal and spino-pleural), sometimes these may be ill-developed on anterior tergites or on head. Frontal horns short, rounded at apex. Ultimate rostral segment $0.45-0.60 \times$ as long as second segment of hind tarsus

P. panicola (Takahashi)

Head, thorax and basal abdominal segments without well developed wax glands ; Marginal wax gland cell groups always present on post siphuncular tergites of abdomen; meso-and meta-thorax and anterior tergites often with dark scleroites, perhaps bearing wax pores

3

3. Frontal horns long, stout, sharply pointed at apex, curved outward, $1.3-1.7 \times$ as long as antennal segment II and with 6-8 hairs. Dorsal cephalic hairs $1.1-1.2 \times$ as long as basal diameter of antennal segment III. Body upto 4.0 mm long

P. alexanderi (Takahashi)

Frontal horns short, $0.58-0.85 \times$ as long as antennal segment II, with 3-4 hairs. Dorsal cephalic hairs. $1.6-2.1 \times$ as long as basal diameter of antennal segment III. Body upto 2.5 mm long

P. orientalis (Agarwala,
Mondal and
Raychaudhuri)

Alate viviparous females :

1. Dorso-apical hairs on second tarsal segments with funnel-shaped apices. Frontal horns small, blunt. Antennae $0.32-0.49 \times$ as long as body, segment III distinctly longer than IV+V taken together. Ultimate rostral segment ± 0.06 mm long, second segment of hind tarsus ± 0.10 mm long

.P. panicola (Takahashi)

Dorso-apical hairs of two types, one with expanded apex, other with normal apex. Ultimate rostral segment $\pm 0.08-0.108$ mm long, second segment of hind tarsus $\pm 0.109-0.228$ mm long

.. .. 2

2. Forewings without pale area along the inner margin of subcosta and pterostigma long. Ultimate rostral segment ± 0.108 mm long, second segment of hind tarsus ± 0.198 mm long. Cauda with about 12 hairs. Body 2.2-2.8 mm

.P. bucktoni Ghosh, Pal
and Raychaudhuri

Forewings with a distinct pale area along inner margin, extending all along the length of subcosta..

3

3. 8th tergite with 6 hairs. Cauda with 10.12 hairs. Ultimate rostral segment ± 0.100 mm long, second segment of hind tarsus ± 0.200 mm long. Antennal segment III about $1.20 \times$ as long as segment IV+V taken together. Body upto 3.0 mm long

.P. alexanderi (Takahashi)

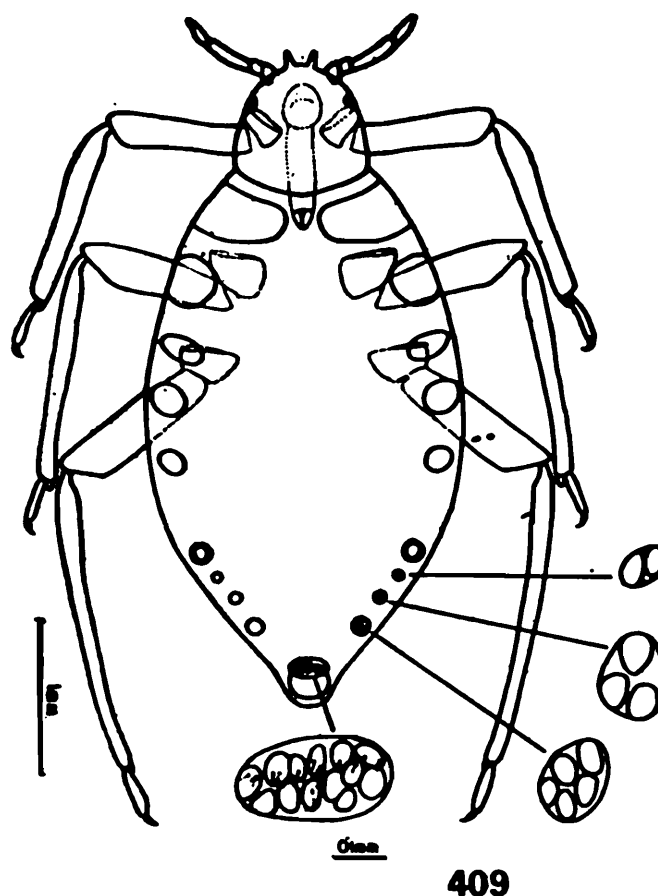
8th tergite with 3-4 hairs. Cauda with 16-20 hairs. long, ultimate rostral segment ± 0.080 mm long, second segment of hind tarsus ± 0.140 mm long. Antennal segment III equal or little shorter than segments IV+V taken together. Body upto 2.4 mm

.P. orientalis (Agarwala
Mondal and
Raychaudhuri)

**59. *Pseudoregma alexanderi* (Takahashi)
(Figs. 409-418)**

1924. *Oregma alexanderi* Takahashi, R., Aphididae of Formosa, 3 : 81.
1931. *Oregma alexanderi* Takahashi, R., Dep. Agric. Govt. Res. Inst. Formosa Rept., 53 : 97.
1968. *Pseudoregma alexanderi* (Takahashi) Basu, A.N., Orient. Ins., 3.
1974. *Paraoregma alexanderi* (Takahashi), Ghosh, M.R., Pal, P.K. and Raychaudhuri, D.N., Proc. zool. Soc. Calcutta, 27 : 106.
1976. *Pseudoregma alexanderi* (Takahashi), Eastop, V.F. and Hille Ris Lambers, D., Survey of the World's Aphids, 366.
1980. *Paraoregma alexanderi* (Takahashi), Raychaudhuri, D. N., Ghosh, M.R., Pal, P.K., and Ghosh, A.K., In Aphids of North East India and Bhutan, 388.

Apterous viviparous female : Body 2.14-4.30 mm long with 1.2-2.0 mm as maximum width. Head fused with pronotum, brownish anteriorly, bearing numerous irregular, dorsal wax pores and a pair of long, conical frontal horns with blumish apices, $1.3-1.7 \times$ as long as antennal segment II ; dorsal cephalic hairs 0.16-0.46 mm long, with acuminate to blunt apices, longest one $1.16-1.20 \times$ as long as the basal diameter of antennal segment III. Antennae 4-5-segmented, brownish, except on last segment which is darker, $0.14-0.20 \times$ as long as the body ; flagellum gradually more distinctly imbricated apicad ; hairs on flagellum sparse, fine, on segment III 0.016-0.030 mm long, $0.5-0.9 \times$ as long as the basal diameter of the segment ; processus terminalis $0.27-0.40 \times$ as long as base of last antennal segment. Rostrum reaches beyond forecoxae, ultimate rostral segment blunt, $0.40-0.47 \times$ as long as the second segment of hind tarsus, without any accessory hairs. Abdominal dorsum pale, bearing marginal sclerites on 1st-7th tergites each bearing a single hair, and a spino-pleural sclerite on 8th tergite ; sometimes small spinal sclerotic patches



409

Pseudoregma alandri (Takahashi). Apterous viviparous female : 409, whole body.

may be present on anterior tergites ; hairs on dorsum of abdomen fine, 0.05-0.09 mm long, on anterior tergites, $1.0-2.1 \times$ as long as the basal diameter of antennal segment III ; 8th tergite with 4 hairs, upto $1.6-2.2 \times$ as long as the mentioned diameter. Meso-and meta-thorax usually with wax pores or glands of 1-2 cells ; marginal sclerites on abdomen with wax pores or cells on 1st-4th tergites but almost always with distinct wax glands on 5th-7th tergites ; spino-pleural sclerite on 8th tergite with a single wax gland composed of 6-10 irregular shaped cells. Siphunculi on brown sclerotic cones surrounded by fine hairs. Cauda dusky, bearing 8-10 hairs. Subanal plate bilobed, bearing 7-9 hairs on each lobe. Legs brown, smooth, with fine hairs ; longest hair on hind tibiae 0.050-0.60 mm long, $0.75-1.1 \times$ as long as the diameter at the middle of the tibia ; tarsi darker than rest of legs, first tarsal segments with 4,4, 2 or 4,3,2 hairs ; one dorso-apical hairs on 2nd tarsal segment flattened at apex, other with normal apex.

	Antennal segments		urs	ht ₂
III	IV	V		
0.29	(0.13+0.04)	—	0.10	0.25
0.20	(0.11+0.04)	—	0.09	0.23
0.19	(0.11+0.03)	—	0.09	0.23
0.18	0.10	(0.13+0.04)	0.11	0.24

(1, 2, 3, ex Bamboo, Shillong, Meghalaya, 2.x.1975, ZSI ; 4, ex. Bamboo, Darjeeling, West Bengal, 2.xii.1968, C.U.).

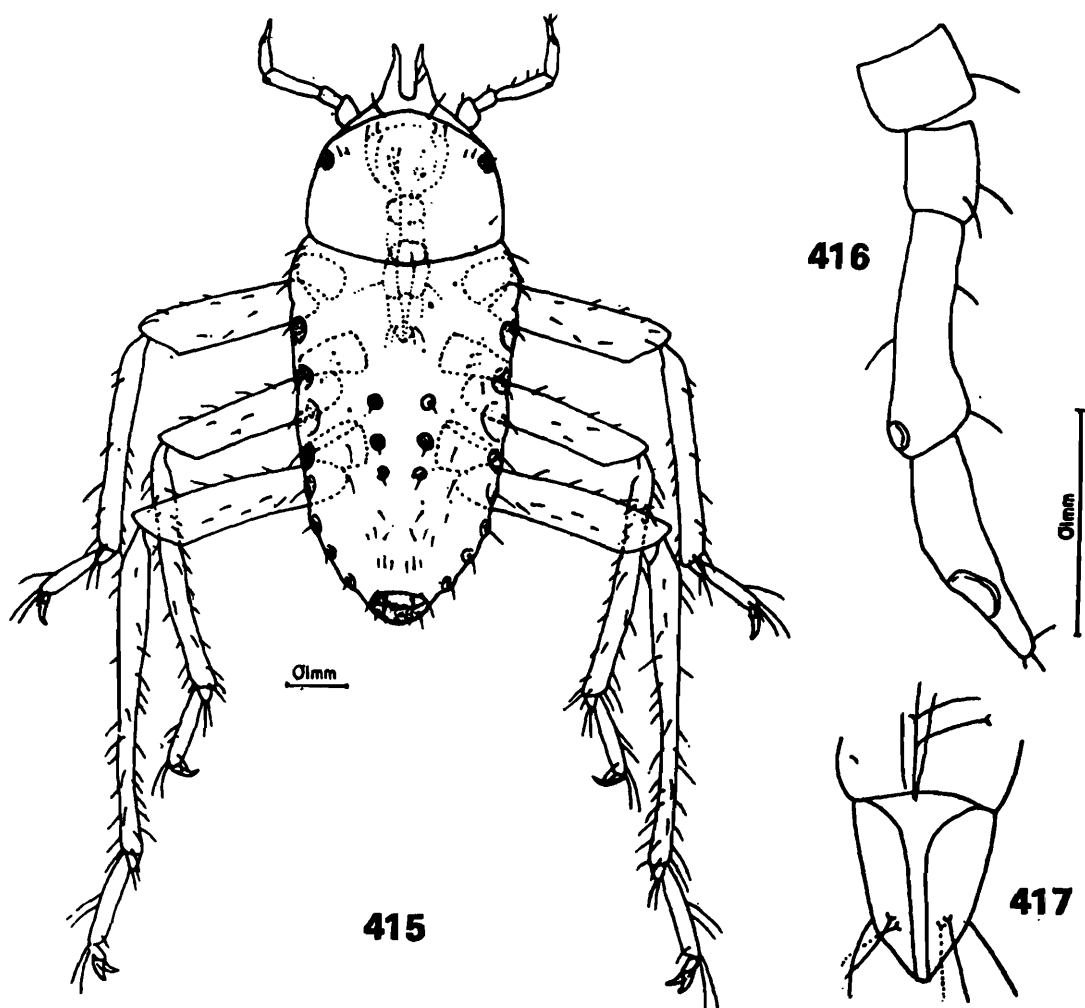
Nymph (Apterous : early stage) : Body 1.15 mm long with 0.44 mm as maximum width. Head fused with prothorax, bearing a pair of sharply pointed frontal horns, $3.0\times$ as long as antennal segment II and equal to antennal segment III ; dorsal cephalic hairs fine, 0.016-0.023 mm long, ventral hairs upto 0.073 mm long. Antennae 4-segmented, dusky brown, $0.30\times$ as long as the body ; antennal hairs fine, 1-2 per segment, 0.016-0.026 mm long, $0.60-1.0\times$ as long as the basal diameter of antennal segment III ; flagellum with distinct spinulose imbrications on segment IV ; processus terminalis $0.37\times$ as long as base of last antennal segment. Rostrum reaches near midcoxae ; ultimate rostral segment $0.40\times$ as long as second segment of hind tarsus. Abdominal dorsum pale bearing small to moderate-sized marginal sclerotic areas each bearing wax pores or feeble wax glands and a single hair ; wax pores also variably present on marginal sclerites of meso-and meta-thorax and on cephalothorax ; hairs on the dorsum of abdomen arranged in spinal, pleural and marginal pair, 6 per segment on 1st-7th tergites, while 8th tergite with only a pair of spinal hairs, these being 0.026-0.056 mm long but decidedly longer on 6th-8th tergites, and $1.0-2.5\times$ as long as the basal diameter of antennal segment III. Siphunculi not evident. Cauda with 2 hairs. Legs pale, long, slender, hind tibiae distinctly curved inwards ; hairs on tibiae long, flagellate, longest one on hind tibiae 0.083 mm long, $2.5\times$ as long as the diameter at the middle of the tibiae ; first tarsal segments with 3, 3, 2 hairs ; dorso-apical hairs on 2nd tarsal segments $1.4\times$ as long as the claws, with slightly expanded apices ; empodial hairs fine, distinctly shorter ($0.80-0.85\times$) than the claws.

Colour : Brown in life.

Measurements in mm. :

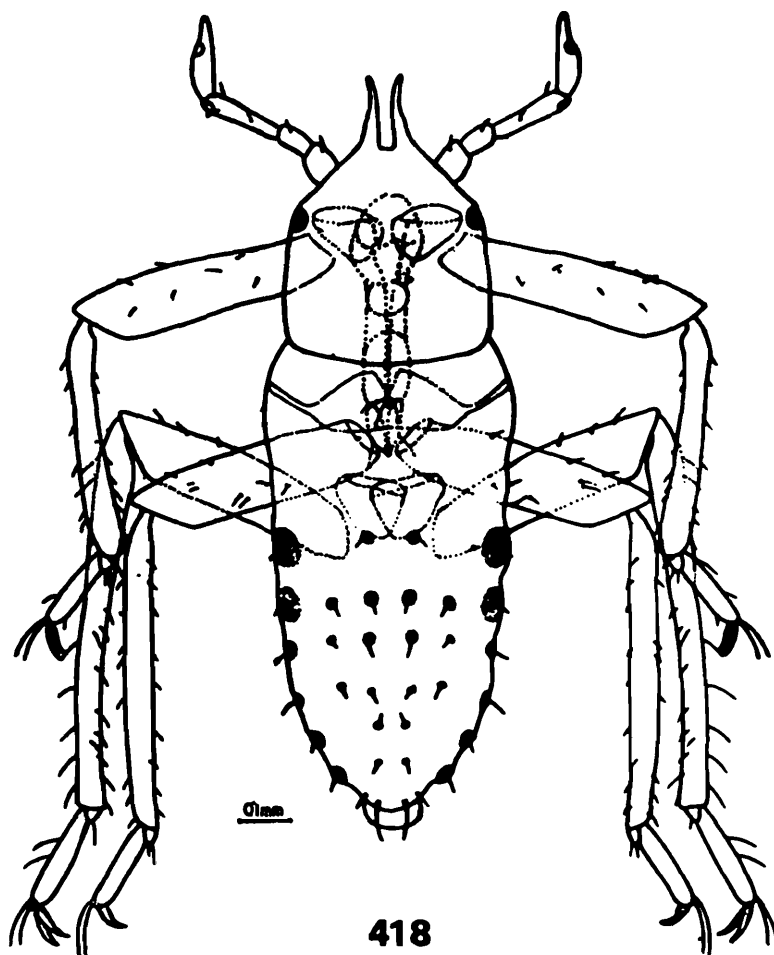
Length		Width		Antenna	
1.15		0.44		0.34	
Antennal segments				urs	ht ₂
I	II	III	IV		
0.053	0.050	0.115	(0.07+0.03)	0.006	0.21

(ex Bamboo, Shillong, Meghalaya, 2.x.1975, Z.S.I.).



Apterous nymph (early stage) : 415, whole body ; 416, antenna ; 417, ultimate rostral segment ;

Alate viviparous female : Body 1.0-2.95 mm long with 0.70-1.24 mm as maximum width. Head brownish black bearing a pair of short frontal horns, $0.33\times$ as long as antennal segment II. Antennae 5-segmented, brown to dark brown, $0.35-0.45\times$ as long as the body ; flagellum with spinulose imbrications and bearing annular secondary rhinaria on III, IV and V antennal segments ; hairs on flagellum sparse, short and fine ; processus terminalis $0.14-0.16\times$ as long as base of last antennal segment. Rostrum reaches midcoxae, ultimate rostral segment long, sub-acute, $0.41-0.58\times$ as long as second segment of hind tarsus. Abdominal dorsum pale with marginal sclerites around spiracles and transverse sclerotic band on 7th and 8th tergites ; hairs on the dorsum of abdomen short, fine, on anterior tergites at most equal to basal diameter of antennal segment III ; 7th and 8th tergites each with 6 hairs, longest one upto $2.0\times$ as long as the mentioned diameter. Siphunculi with sclerotic rims. Cauda with



Apterous. nymph (late stage) : 418, whole body.

11-12 hairs. Legs dark brown, smooth except near apices of tibiae which are finely spinulose ; first tarsal segments with 4, 4, 2 hairs. Wings with veins bordered brown ; forewings with pterostigma extending to 0.75 portion of radial sector and a pale area bordering inner margin of subcosta.

Colour : Brown to dark brown in life.

Measurements in mm. :

	Length	Width	Antenna	
1.	2.70	1.20	1.07	
2.	2.90	1.22	1.18	
	Antennal segments			
III	IV	V	urs	ht ₂
0.53	0.20	(0.20+0.03)	0.09	0.20
0.65	0.23	(0.20+0.04)	0.10	0.22

(1, 2, ex. Bamboo, Kalimpong, West Bengal, 10.xii.1968, C.U.).

Material examined : Many apterous and alatae viviparous females from Bamboo, Cherrapunji, Meghalaya, 22-28.x.1968, coll, R.C. Basu (C.U.) ; Shillong, Meghalaya, 2.x.1975, coll. R. Mathew, (ZSI) ; Kalimpong, Darjeeling district, West Bengal, XII-1968 to XII-1971 ; Peshok, Darjeeling district, 18.iii.1971 ; Gangtok, Sikkim, 10.iii.1971, colls, M.R. Ghosh, (C.U.).

Discussion : These insects form colonies on young shoots of bamboo (*Bambusa arundinaeca* and *Bambusa* spp., *Dendrocalamus* spp., *Phyllostachys* sp.) and remain covered with powdery wax secretion. Pal (1975) recorded this species throughout the year on localities between c 900 m-1200 m, in Darjeeling district of West Bengal. Heavy infestation has been noted during the months of March-May. These insects secrete profuse hony dew imparting a sticky appearance to the infested part and are often attended by ants.

Raychaudhuri *et al.* (1978) reported the coleopterous predators, *Synonymcha grandis* (Th.) and *Calliphora paltoni* feeding on this species in Kalimpong, West Bengal during July, 1976.

Aoki *et al.* (1981) mentioned that besides normal 1st instar larvae this species also produces 'pseudoscorpion-like' 1st instar larvae which are characterised by large body size, enlarged fore-legs and well developed frontal horns with acute apices. In Taiwan, apterous viviparous females propagate parthenogenetically throughout the year on *Dendrocalamus latiflorus* and produce many pseudoscorpion-like larvae from October to December and also in April-May, which remain sterile and do not exhibit any moulting. Normal larvae become alate sexuparae during April-May and imigrate to primary host, if one is present. Pseudoscorpion-like larvae act as soliders against insect predators eg. *Synonymcha grandis*, *Pseudocymmus amplus* and also competitor aphid species like *Astegopteryx bambusifoliae*; for the purpose of defence, frontal horns are intended to pierce and enlarged legs are used for clasping.

Originally described under *Oregma*, the species was transferred to *Pseudoregma* by Basu (1968) and was subsequently made the type species of the newly erected genus *Paraoregma* by M.R. Ghosh, Pal and Raychaudhuri (1974). Considering the range of variations of morphological characters and its close affinity with other members of *Pseudoregma*, this species is treated here under *Pseudoregma*.

Distribution : India : Sikkim, West Bengal, Meghalaya, Nagaland, Manipur ; Nepal ; Taiwan.

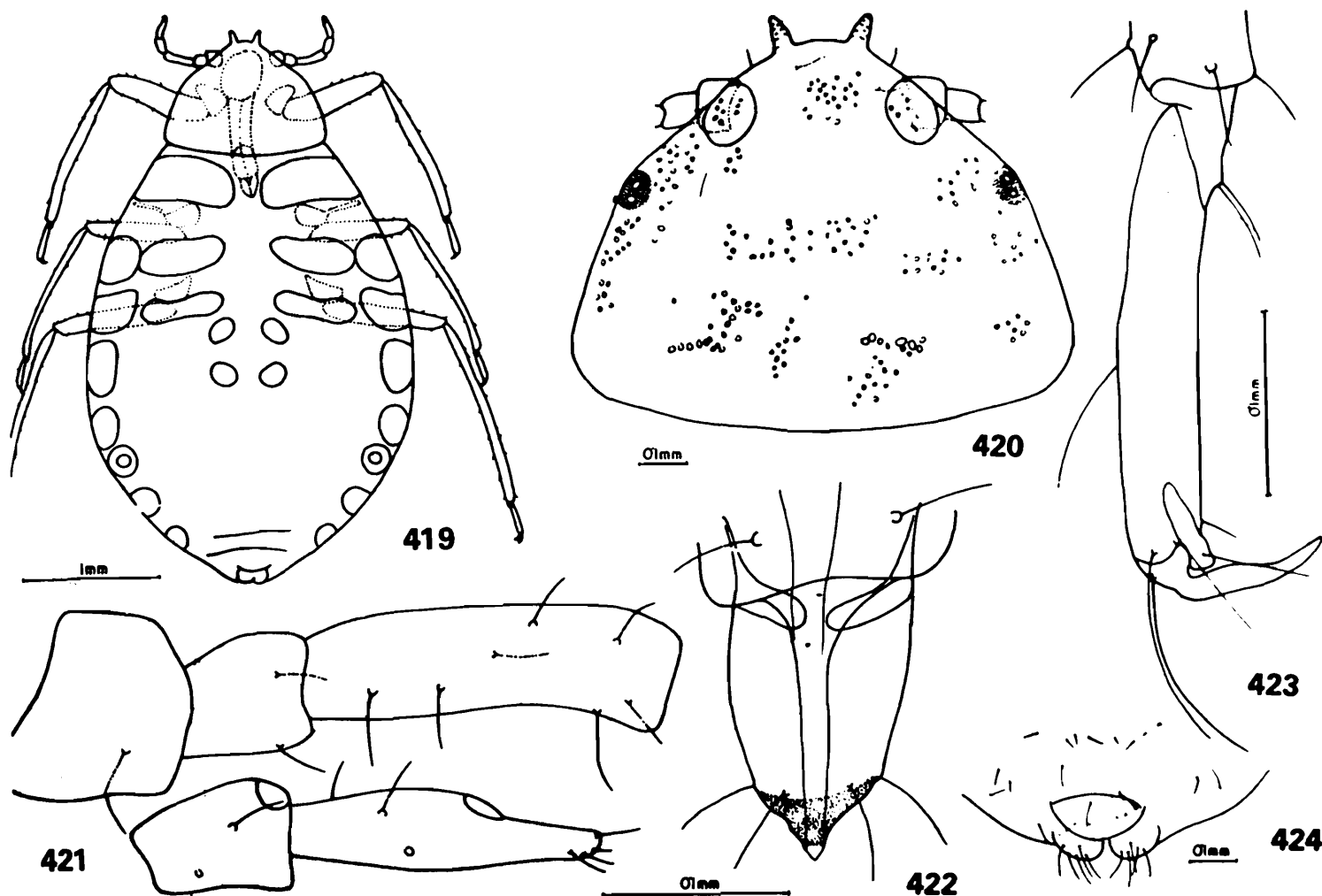
Types : Probably in the Agricultural Research Institute, Taipei, Taiwan.

60. *Pseudoregma bucktoni* Ghosh, Pal & Raychaudhuri
(Figs. 419-439)

1893. *Oregma bambusae* Buckton, G.B., *Indian Mus. Notes*, 3 : 8-7 (*partim*).
1958. *Oregma bambusae*, David, S.K., *Ind. J. Ent.*, 20 : 127.
1961. *Oregma bambusae*, Basu, A.N., *Sci. Cult.*, 27 : 456.
1963. *Oregma bambusicola*, Behura, B.K., *Proc. First Summer School zool.*, 66 (misid.).

1966. *Pseudoregma bambusicola*, Doncaster, J.P., *The Entomologist*, **99** : 159 (misid.).
1969. *Pseudoregma bambusicola*, David, S.K. and Rajasingh, S.G., *Proc.zool. Soc. Calcutta*, **22** : 156 (misid.).
1970. *Pseudoregma bambusicola*, Ghosh, A.K., Basu, R.C. and Raychaudhuri, D.N., *Orient, Insects*, **4** : 72 (misid.).
1970. *Pseudoregma bambusicola*, Ghosh, L.K., *Sci. Cult.*, **36** : 563 (misid.).
1971. *Pseudoregma bambusicola*, Ghosh, M. R., Ghosh, A.K. and Raychaudhuri, D.N., *Proc. zool. Soc. Calcutta*, **24** : 167 (misid.).
1974. *Pseudoregma bambusicola*, Basu, R.C., *Sci., Cult.*, **40** : 43 (misid.).
1974. *Pseudoregma bucktoni* Ghosh, M. R., Pal, P. K. and Raychaudhuri, D.N., *Proc. zool. Soc. Calcutta*, **27** : 113.
1976. *Pseudoregma bambusicola*, Eastop, V.F. and Hille Ris Lambers, D., *Survey of the World's Aphids*, 366 (Type of *Pseudoregma*) (misid.).
1980. *Pseudoregma bucktoni*, Raychaudhuri, D.N., Ghosh, M.R., Pal, P. K. and Ghosh, A.K., *In Aphids of North East India and Bhutan.*, 391.

Apterous viviparous female : Body brown to dark brown, 2.32-3.20 mm long with 1.50-2.15 mm as maximum width. Head fused with prothorax, bearing a pair of small, bluntly conical frontal horns, about $0.60-0.66 \times$ as long as antennal segment II ; vertex covered with small, irregularly shaped denticles, densely so on anterior region but usually absent from lateral areas, cephalic hairs 0.025-0.065 mm long, fine, $1.0-2.5 \times$ as long as the basal diameter of antennal segment III. Antennae 4-5-segmented, $0.12-0.18 \times$ as long as the body ; segment I and II subequal ; hairs on the flagellum 0.016-0.030 mm long, longest one segment III, $0.75-1.10 \times$ as long as basal diameter of the segment ; processus terminalis $0.23-0.36 \times$ as long as base of last antennal segment. Rostrum short, hardly reaching midcoxae, ultimate rostral segment $0.47-0.60 \times$ as long as second segment of hind tarsus, without any accessory hairs. Pronotum (in cephalothorax), with a pair of elongate oval swelling bearing denticles ; mesonotum with a pair of less prominent, more sclerotised, large denticulate swelling and metanotum covered with denticles on irregular, often broken sclerotic areas, specially on spinal and pleural region. Abdominal dorsum covered with denticles, and bearing many small irregular scleroites, each with 1 or 2 hairs, besides large denticulate marginal sclerites which become smaller caudad ; hairs on the dorsum of abdomen fine, acute, 0.030-0.050 mm long, $1.0-2.0 \times$ as long as the basal diameter of antennal segment III ; 8th tergite with a median sclerite and bearing 3-5 fine hairs, 0.060-0.073 mm long. Wax gland-like cells (3-4) present in front of



Pseudoregma bucktoni (Buckton). Apterous viviparous female : 419, whole body, 420, head ; 421, antenna ; 422, ultimate rostral segment ; 423, hind tarsus ; 424, caudal region.

pronotal swelling and immediately behind (4-5) and on lateral margin of metanotum. Siphunculi on slightly elevated sclerotic cones. Cauda with 14-20 hairs. Subanal plate bilobed, with 11-12 hairs in each lobe. Legs smooth ; hairs on femora and tibiae fine, 0.03-0.05 mm long, longest hair on hind tibiae upto 0.70-0.75 $\times$ as long as the diameter at the middle of the tibia ; first tarsal segments with 4, 4, 2 hairs, tarsi of fore-and-mid leg with an outer pair of fine hairs and inner pair of shorter sensillae, the last being absent in hind tarsi ; empodial hairs fine.

Colour : Dirty grey or brownish in life.

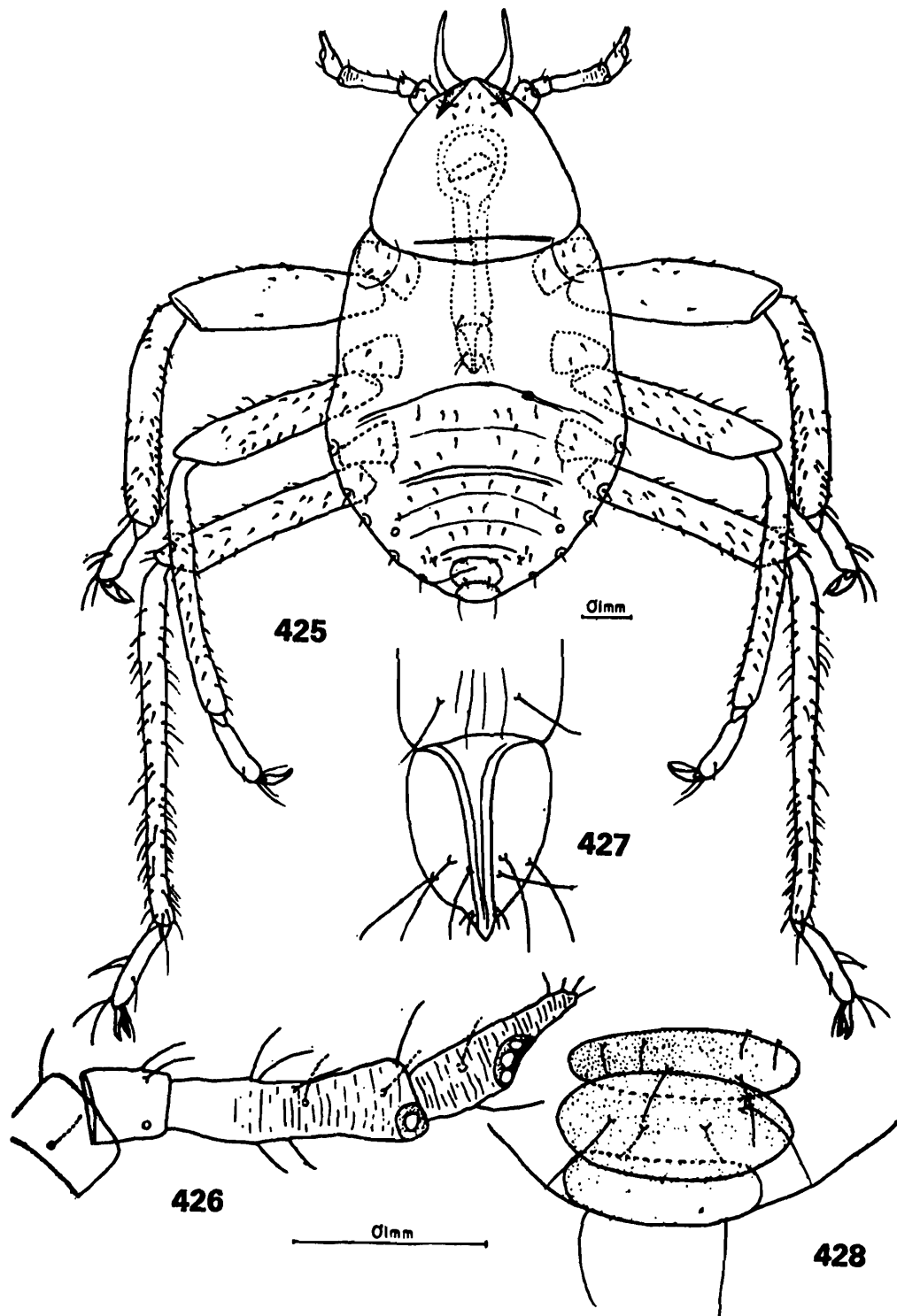
Measurements in mm. :

	Length	Width	Antenna
1.	3.01	2.13	0.44
2.	3.17	1.87	0.50
3.	2.90	1.69	0.48

	Antennal segments			urs	ht ₂
III	IV	V			
0.19	0.09	(0.09+0.04)	0.12	0.23	
0.18	0.08	(0.08+0.04)	0.12	0.20	
0.17	0.08	(0.08+0.04)	0.12	0.21	

(1, ex *Bambusa* sp., Dehra Dun, U.P., 27.x.1977, K.U. ; 2, ex. Bamboo, Tongon, Manipur, 23.i.1977, ZSI ; 3, ex. Bamboo, Mongpoo, W.B., 23.xii.1969, C.U.).

Nymph (Pseudicorcion-like ; apterous) : Body 1.24 mm long with 0.58 mm as maximum width. Head fused with pronotum, sclerotic, dark bearing a pair of large, slender frontal horns 0.22 mm long, $0.18\times$ as long as the body, $4.0\times$ as long as antennal segment II ; cephalothorax with fine, minute denticles on posterior portion, specially in the spinal region ; cephalic hairs fine, ventral one upto 0.050-0.066 mm long. Antennae 4-segmented, dark brown, $0.27\times$ as long as the body ; flagellum imbricated ; hairs on flagellum fine, segment III with 5-6 hairs, 0.020-0.040 mm long, $0.9-1.2\times$ as long as the basal diameter of the segment ; processus terminalis $0.45\times$ as long as base of last antennal segment. Rostrum reaches midcoxae, ultimate rostral segment $0.52\times$ as long as second segment of hind tarsus. Mesothorax, metathorax and abdominal tergites 1st-3rd with distinct marginal sclerites and abdominal tergites 4th to 7th with faint, smaller sclerites ; abdominal segmentation distinct, dorsal hairs fine ; 1st-6th tergites each with 6 hairs, 7th tergite with 4 hairs ; 8th tergite with 2 hairs,



Apterous nymph (with long frontal horn) : 425, whole body ; 426, antenna ; 427, ultimate rostral segment ; 428, caudal region.

these being 0.030-0.040 mm long, 1.0×1.4 as long as the basal diameter of antennal segment III ; ventral hairs arranged segmentally in a row on 1st-6th tergites. Cauda with 2 hairs, 0.060 mm long. Legs dark brown ; fore femora much thicker and stouter than other femora ; hairs on femora and tibiae numerous, fine, on hind tibiae 0.083-0.106 mm long, upto $2.1 \times$ long as the diameter at the middle of the tibia ; first tarsal segments with 2, 2, 2 fine, flagellate hairs, 0.083-0.100 mm long.

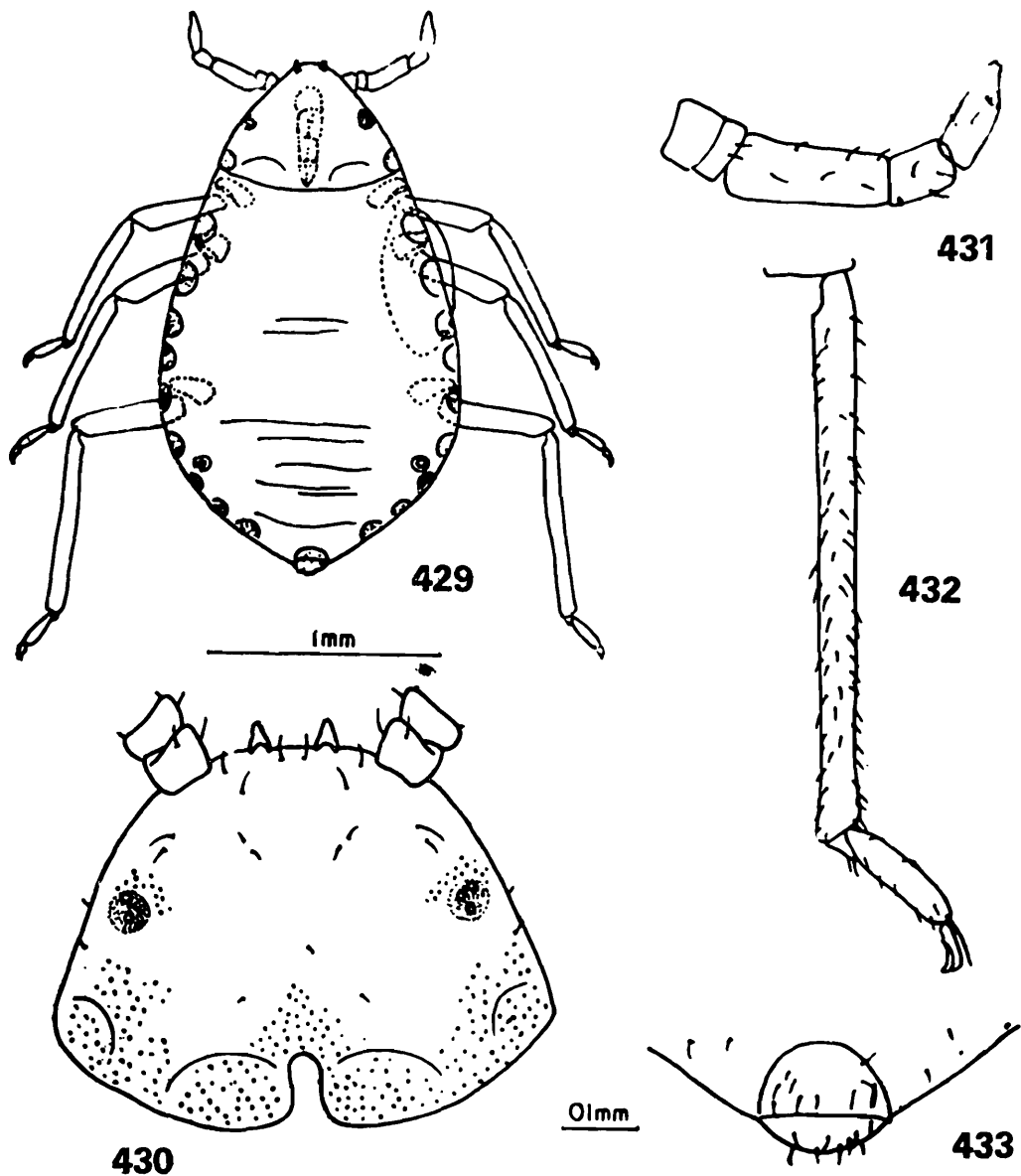
Colour : Dirty grey to brown.

Measurements in mm. :

	Length		Width	Antenna		
1.	1.24		0.58	0.34		
	Antennal segments				urs	ht ₂
I	II	III	IV			frontal horns
0.05	0.05	0.13	(0.07+0.03)	0.10	0.21	0.22

(ex Bamboo, Mongpoo, West Bengal, 23.xii.1969, C.U.).

Nymph (Normal, apterous) : Body 1.24 mm long with 0.64 mm as maximum width. Head and pronotum fused, forming a solid brown sclerotic area ; frontal horns slender, 0.13 mm long, $0.10 \times$ as long as the body, $2.6 \times$ as long as 2nd antennal segment. Dorsal cephalic hairs, 0.023-0.040 mm long, $0.70-1.20 \times$ as long as the basal diameter of antennal segment III ; ventral hairs on frons upto 0.086 mm long, $2.6 \times$ as long as the mentioned diameter ; cephalothorax with distinct denticles, more densely so on median and posterior region ; pronotum with a pair of swelling, mesonotum with a similar but larger pair covered with denticles. Mesothorax, metathorax and 1st-7th abdominal tergites with paired brown, marginal sclerites, variably covered with denticles, those on 4th-7th tergites being much smaller ; each of the marginal sclerites with 1 or 2 hairs, upto 0.033-0.043 mm long. Abdominal dorsum with small irregular, brownish, hair bearing sclerites in spino-pleural region ; hairs on the dorsum of abdomen fine, 0.016-0.026 mm long, 6 per segment on 1st-6th tergites ; 7th tergite with 4 hairs and 8th tergite with 2 hairs, 0.036-0.040 mm long,



Apterous nymph (with short horn) ; 429, whole body ; 430, head ; 431, antenna ; 432, hind leg ; 433, caudal region.

upto $1.6\times$ as long as the basal diameter of antennal segment III. Subanal plate and cauda each with 2 hairs. Legs dark brown ; all femora appear normal ; hairs on femora and tibiae fine, longest one on hind tibiae 0.073 mm long, $1.5\times$ as long as the diameter at the middle of the tibia ; first tarsal segments with 2, 2, 2 hairs, upto 0.073 mm long.

Colour : Dark grey to brown in life.

Measurements in mm :

Length				Width	Antenna	
1.24				0.64	0.34	
Antennal segments				urs	ht ₃	frontal
I	II	III	III			horns
0.05	0.05	0.13	(0.08+0.03)	0.115	0.19	0.134

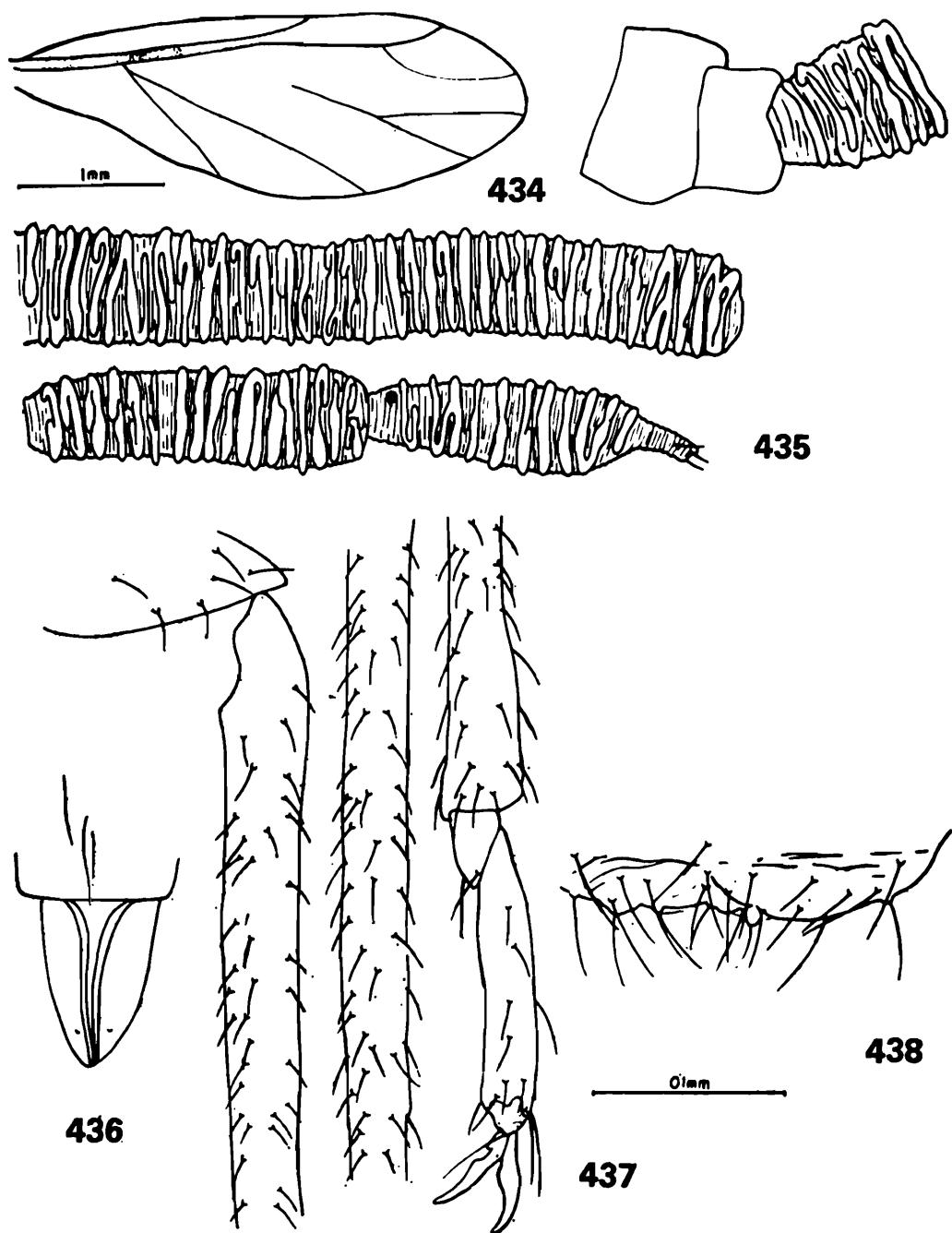
(ex Bamboo, Mongpoo, West Bengal, 23.xii.1969, C.U.).

Alate viviparous female : Body 2.2-2.8 mm long with 1.0-1.5 mm as maximum width. Head blackish brown bearing a pair of very short blunt frontal horns, cephalic hairs 0.016-0.020 mm long. Antennae 5-segmented, $0.32-0.40\times$ as long as the body ; flagellum with spinulose imbrications ; segments III, IV and V with 37-42, 13-15 and 11 annular secondary rhinaria, respectively ; hairs on the antennae fine, very sparse, 0.010-0.016 mm long $0.40-0.60\times$ as long as the basal diameter of antennal segment III ; processus terminalis $0.25-0.35\times$ as long as base of last antennal segment. Rostrum reaches midcoxae, ultimate rostral segment $0.55-0.67\times$ as long as second segment of hind tarsus. Abdominal dorsum pale, with sclerotic areas around spiracles, broken sclerotic transverse bands on 6th and 7th and a continuous sclerotic band on 8th tergite ; hairs on the dorsum of abdomen fine, upto 0.033-0.040 mm long, $1.2-1.5\times$ as long as the basal diameter of antennal segment III. Siphunculi poriform on brown sclerotic coxae. Cauda with 11-12 hairs. Subanal plate bilobed. Legs brown with basal portion of femora pale ; first tarsal segments with 4, 4, 2 hairs ; one of the dorso-apical hairs on second tarsal segment flattened at apices. Wing venation normal, veins stout and brown.

Colour : Brownish-black in life.

Measurements in mm. :

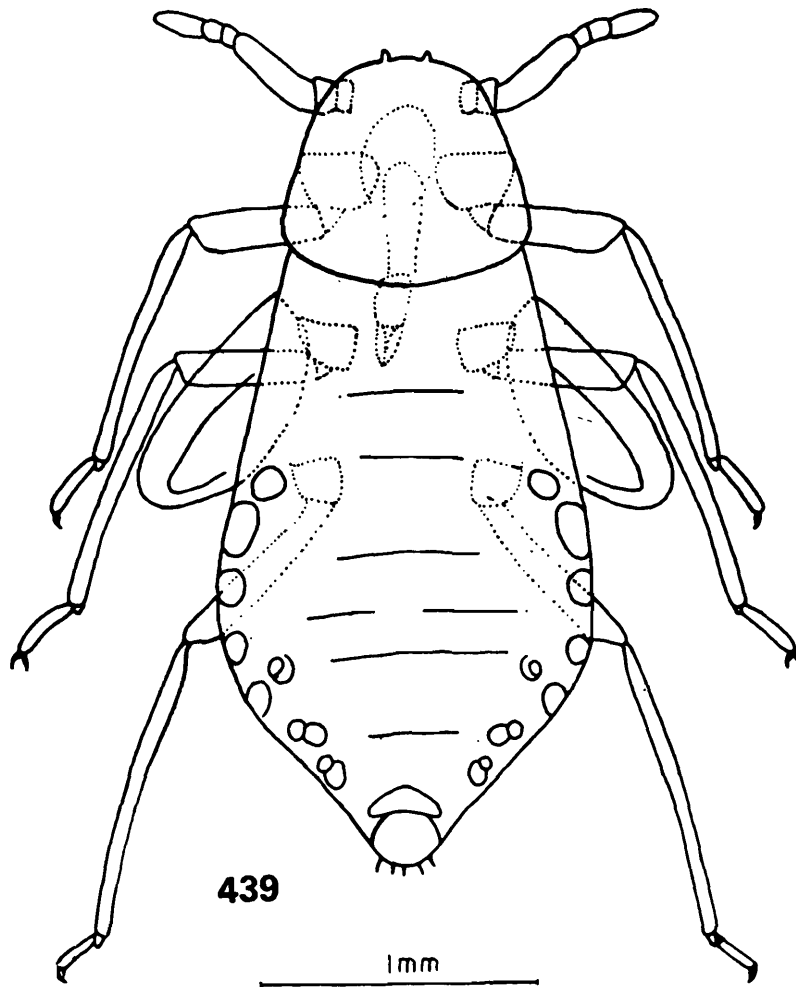
	Length	Width	Antenna
1.	2.76	1.31	0.99
2.	2.40	1.43	0.99



Alate viviparous female ; 434, forewing ; 435, antenna ; 436, ultimate rostral segment ; 437, part of hind leg ; 438, caudal region.

Antennal segments			urs	ht ₂
III	IV	V		
0.52	0.20	(0.15+0.04)	0.10	0.16
0.53	0.19	(0.14+0.04)	0.10	0.17

(1, 2, ex Bamboo, Mongpoo, West Bengal, 23.xii.1969, C.U.).



Alate nymph : 439, whole body.

Material examined : Several apterae, nymphs and alatae, from Bamboo, Mongpoo, Darjeeling district, West Bengal, India, 23.xii.1969, coll, M.R. Ghosh (C.U.), Dehra Dun, Uttar Pradesh, India, 27.x.1973, coll. S.P. Maity (K.U.), Tongon, Manipur, India, 23.i.1977, coll, S.G. Patil ; (X.S.I.) ; 10 apterous viviparous females larva and nymphs from Bamboo shoots, Ceylon, April 1893, coll. E.E. Green, det, J.P.D., (Old No. 4703/13) (Paratypes 1264-1267/H7, 7272-7275/H7 ; 7270-7276-7280, H7 in National Zoological collections, Z.S.I., Calcutta).

Discussion : Doncaster (1966), while re-examining type material of *O. bambusae* Buckton, noted six slides deposited in British

Museum (Nat. Hist), London, material for four of which were collected in Dehra Dun, India and rest from Ceylon (Sri Lanka) ; besides, he also examined 11 apterae, one nymph and some larvae, as part of type material, all collected from Sri Lanka, and deposited in the Zoological Survey of India. According to him, all material from Dehra Dun conform to Buckton's (1893) description of *bambusae* and appear identical with *O. lutescens* van der Goot, 1917 and should be treated as under *Astegopteryx* Karsch 1890, thinking the generic name *Oregma* Buckton, 1893, of which *bambusae* Buckton is the type, as a synonym of *Astegopteryx*. Doncaster (op. cit) further stated that all the material from Sri Lanka belongs to a different species *bambusae*, *sensu* van der Goot (1917), and should now be treated under a new name for which, without assigning any reason, he used the name *bambusicola* Takahashi, 1921 ; the latter also forms the type species of his new genus *Pseudoregma* Doncaster. M.R. Ghosh *et al.* (1974) after examining material of *bambusicola* Takahashi, 1921 determined by R. Takahashi, opined that *bambusicola* is a distinctly different species from the one described in details by Doncaster (1966) under the same name, as the type species of *Pseudoregma* Donc., and proposed a new name *bucktoni* to replace *bambusicola*, *sensu* Doncaster.

This species infests young stems and undersurface of leaves of *Bambusa arundinacea* and other indet. Bamboo species and produces copious honey dew. Pal (1975) reported its occurrence throughout the year in Darjeeling district, more frequently during the months of April-May and September to December, at localities between c 900 m-1200 m. Available data from Meghalaya, indicates its occurrence between August to January. Behura (1963) listed from earlier records, three coccinellids *Anisolemnia dilatata* (Fabr.), *Synonyoha crandis* Thumb, & *Pullus* sp., predated on this insect in Karnataka during the month of August. Ant attendance is not uncommon.

Distribution : India : Sikkim, West Bengal, Meghalaya, Manipur, Karnataka, Tamil Nadu ; Sri Lanka ; Taiwan ; Vietnam.

Types : In the National Zoological Collections, Zoological Survey of India, Calcutta, India.

61. *Pseudoregma orientalis* (Agarwala, Mondal and Raychaudhuri)

1982. *Paraoregma orientalis* Agarwala, Basant, K., Mondal, P.L., Raychaudhuri, D.N., *Entomo*, 7 (1) : 42.

Apterous viviparous female : (based on original description) Body 2.2-2.5 mm long with 1.3-1.6 mm as maximum width. Head fused with pronotum ; cephalic hairs with blunt or acuminate apices ; dorsum of cephalothorax with numerous wax pores. Antennae 4-segmented, $0.14-0.24\times$ as long as the body ; flagellum imbricated ; hairs on antennae sparse, longest one on segment III, $0.62-1.0\times$ as long as the basal diameter of the segment ; process terminalis $0.58-0.60\times$ as long as base of last antennal segment. Rostrum reaches near midcoxae, ultimate rostral segment blunt, $0.52-0.60\times$ as long as second segment of hind tarsus, without any accessory hairs. Abdominal dorsum pale ; 4th-6th tergites with marginal sclerites, bearing wax glands (each with 5-8 cells) ; 1st-7th tergites with spino-pleural sclerites bearing wax glands (2-5 cells) ; meso-thorax, metathorax and 1st-3rd tergites with pigmented sclerotic areas with wax pores ; 8th tergites with a transverse, spino-pleural wax gland (11-13 cells) on a sclerotic band ; hairs on dorsum of abdomen fine, one on each marginal sclerites besides others on spino-pleural areas ; 8th tergite with 4 hairs, $2.5-3.3\times$ as long as the basal diameter of antennal segment III. Siphunculi on brown elevated cones, without any hairs. Cauda with 7-9 fine hairs. Subanal plate bilobed. Legs pale brown, femora and tibiae smooth, bearing many fine hairs ; first tarsal segments with 4, 4, 2 hairs ; one of the dorso-apical hairs on second tarsal segment flattened at apex, other with acute apex.

Colour : Not recorded.

Measurements in mm. :

Length	Width	Antenna	Antennal segments		urs	ht ₂
			III	IV		
2.50	1.46	0.36	0.14	(0.07+0.012)	0.08	0.15

Alate viviparous female (based on original description) : Body 2.37-2.43 mm long with 1.0-1.1 mm as maximum width. Head

with very small frontal horns. Antennae 5-segmented, $0.36-0.42\times$ as long as the body, with spinulose imbrications on I, II and in areas between secondary annular rhinaria on III, IV and V ; hairs on flagellum sparse ; processus terminalis $0.36-0.07\times$ as long as base of last antennal segment. Rostrum tends little beyond mid-coxae, ultimate rostral segment $0.58-0.62\times$ as long as second segment of hind tarsus. Abdominal dorsum pale except on 7th and 8th tergites, each of which bears a transverse sclerotic band ; hairs on the dorsum of abdomen fine ; 8th tergite with 3-4 hairs. Siphunculi with a sclerotic rim. Cauda with 16-20 hairs. Legs dark brown ; hairs on femora and tibiae fine, first tarsal segments with 4, 4, 2 hairs. Forewings with media once branched, pterostigma long extending over major length of radial sector ; wing veins bordered brown.

Colour : Not recorded.

Measurements in mm. :

Length		Width	Antenna	
2.43		1.11	1.03	
Antennal segments			urs	ht ₂
III	IV	V		
0.43	0.23	(0.21+0.01)	0.08	0.14

Nymphs : Not available.

Discussion : No material was available for examination from the Entomology Laboratory, Department of Zoology, University of Calcutta. The description as provided here is based on original description. The species apparently shows affinity with *P. alexanderi* (Tak.) but differs from the former in having shorter frontal horns, fewer hairs on horns and longer dorsal cephalic hairs etc. No collection data is available from original reference.

Distribution : India : Sikkim.

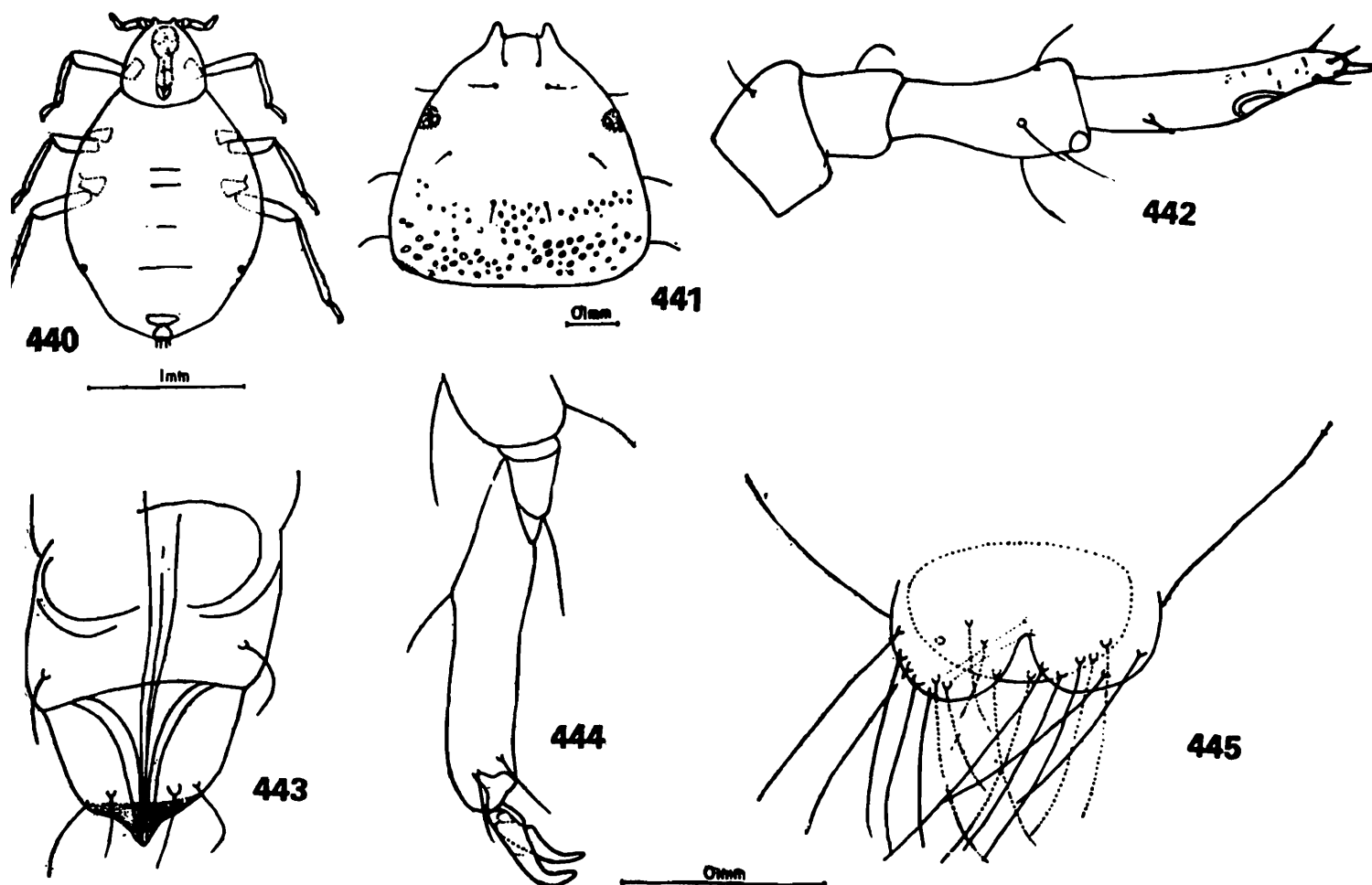
Types : Agarwala *et al.* (1982) mentioned that type-material is deposited in the Aphid Research Unit, Entomology Laboratory,

Department of Zoology, University of Calcutta, India ; however, the same was not available for examination during the present study.

62. *Pseudoregma panicola* (Takahashi)
(Figs. 440-453)

1918. *Oregma panicola* Takahashi, R., Aphidoidae of Formosa, 1 : 90.
 1953. *Oregma panicola*, Cottier, W., Aphids of New Zealand, 318.
 1958. *Oregma panicicola*, Takahashi, R., *Kontyu*, 26: 190.
 1969. *Pseudoregma panicola*, David, S.K. and Rajasingh, S.G., *Proc. zool. Soc. Calcutta*, 22 : 156.
 1969. *Pseudoregma panicola*, Basu, A.N., *Orient. Ins.*, 3 : 364.
 1971. *Pseudoregma panicola*, Ghosh, A.K., Banerjee, H. and Raychaudhuri, D.N., *Gaveshana*, 3 : 10.
 1974. *Neoceratovacuna panicicola*, Ghosh, M.R., Pal, P.K. and Raychaudhuri, D.N., *Proc. zool. Soc. Calcutta*, 27 : 103.
 1974. *Oregma panicola*, Holman, J., *Los Afidas de Cuba*, 47.
 1976. *Pseudoregma panicola*, Eastop, V.F., Hille Ris Lambers ; Survey of the Worlds Aphids, 366.
 1980. *Neoceratovacuna panicicola*, Raychaudhuri, D.N., Ghosh, M.R., Pal, P.K. and Ghosh, A.K., *In Aphids of North East India and Bhutan*, 381.

Apterous viviparous female : Body 1.50-2.0 mm long with 0.90-1.15 mm as maximum width. Head fused with pronotum, brown, bearing a pair of long, blunt frontal horns, equal to the length of antennal segment II ; cephalic hairs fine, 0.033-0.043 mm long, 1.4-2.3 $\times$ as long as the basal diameter of antennal segment III. Antennae 4-5-segmented, brownish in colour, 0.13-0.20 $\times$ as long as the body ; flagellum nearly smooth ; hairs on flagellum sparse ; 0.020-0.040 mm long, longest one on segment III, 0.75-1.3 $\times$ as long as basal diameter of the segment ; processus terminalis 0.25-0.33 (0.50 $\times$) as long as base of last antennal segment. Rostrum reaches little beyond forecoxae, ultimate rostral segment blunt, 0.45-0.60 $\times$ as long as second segment of hind tarsus. Mesothorax, metathorax and abdominal tergites 1st-7th, bearing a pair of marginal and a pair of spinal sclerites, sometimes absent on the post siphuncular tergites ; 8th tergite with a transverse spino-pleural sclerite ; hairs on the dorsum of abdomen 0.033-0.053 mm long, 1.2-2.0 $\times$ as long as basal diameter of antennal segment III ; 7th and 8th tergites each with two hairs, these being 0.033 0.040 and 0.053-0.060 mm long, 1.1-2.4 $\times$ and 1.8-3.0 $\times$ as



Pseudoregma panicola (Takahashi). Apterous viviparous female : 440, whole body ; 441, head ; 442, antenna ; 443, ultimate rostral segment ; 444, hind tarsus ; 445, caudal region.

long as the mentioned diameter respectively. Cephalothorax with numerous scattered wax pores, often with two postero-lateral wax glands, each with several pores or facets, and a pair of 1-2-celled spinal wax glands on the posterior margin ; mesothorax to 5th abdominal tergites, each with 4 groups of wax glands, usually composed of 3-6 cells, sometimes on thoracic tergites, upto 8-10 cells ; 6th and 7th tergites each with 2-3 wax glands with 4-6 cells and 8th tergite with a single wax gland with 6-12 cells. Siphunculi on slightly elevated sclerotic cones, without hairs. Cauda transversely oval bearing 7-8 hairs including a pair of long and stout hairs. Subanal plate bilobed, with 8-12 long hairs on each lobe. Legs darker than head ; hairs on femora and tibiae 0.023-0.050

mm long, longest one on hind tibiae 0.046-0.056 mm long, 1.1-1.2 $\times$ as long as the diameter at the middle of the tibia ; first tarsal segments with 3, 3, 2 hairs ; dorso-apical hairs on second tarsal segments flattened at apices.

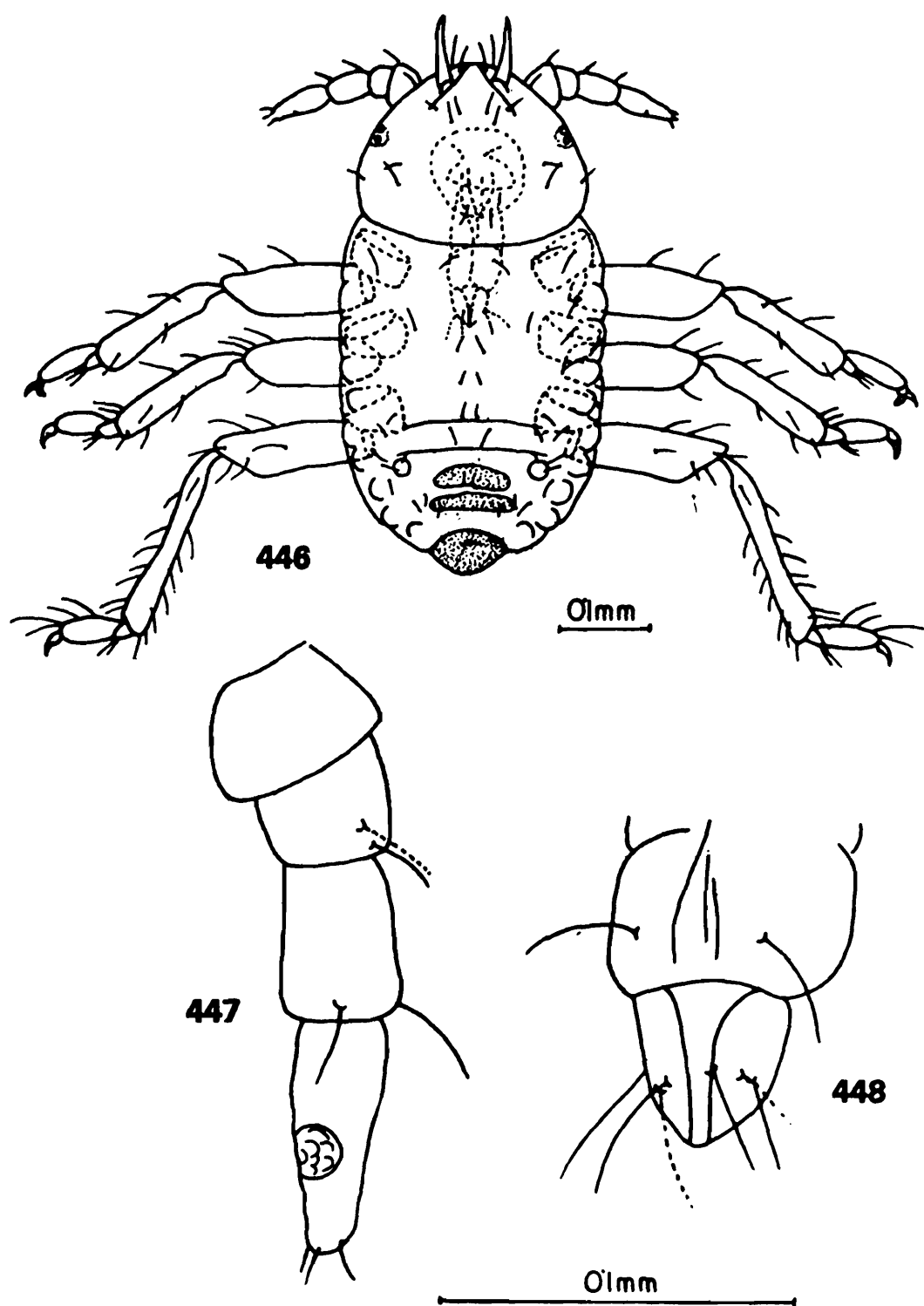
Colour : Dark brown in life.

Measurements in mm. :

	Length	Width	Antenna	
1.	1.79	1.10	0.23	
2.	1.96	1.18	0.39	
3.	1.52	0.96	0.27	
	Antennal segments		urs	ht ₂
III	IV	V		
0.07	(0.06+0.015)	—	0.07	0.12
0.11	0.08	(0.09+0.03)	0.07	0.12
0.11	(0.07+0.02)	—	0.05	0.11

- (1, ex Indet Grass, Peshok, Kalimpong, W.B., 2.iii.1970, C.U. ;
 2. ex Poaceae, Old Barapani, Meghalaya, 17.viii.1973, ZSI ;
 3, ex Poaceae, Shillong, Meghalaya, 19.xii.1973, ZSI).

Nymph (Apterous : early stage) : Body 0.64 mm long with 0.34 mm long with 0.34 mm as maximum width. Head fused with prothorax, pale brown bearing a pair of slender frontal horns 0.10 mm long, 0.16 $\times$ as long as the body ; cephalic hairs fine, flagellate, 0.033-0.040 mm long, upto 1.2 $\times$ as long as the basal diameter of antennal segment III. Antennae 4-segmented, 0.14 $\times$ as long as the body, imbricated on most part of segment IV ; segment I with 1, II and III each with 2 fine hairs and IV with 1 hair, upto 0.026-0.033 mm long, equal to the basal diameter of antennal segment III ; processus terminalis 2.50 $\times$ as long as base of last antennal segment. Rostrum reaches midcoxae, ultimate rostral segment nearly half as long as second segment of hind tarsus. Abdominal dorsum pale bearing distinct marginal oval to rectangular areas, without any sclerotisation or pore but



Apterous nymph ; 446, whole body ; body ; 447, antenna ; 448, ultimate rostral segment.

each bearing a long fine hairs, (0.046-0.053 mm) on 1st-7th tergites ; besides marginal hairs, a pair of similar hairs present on spinal and pleural region on 1st-6th tergites ; 7th tergite with 4

hairs and 8th tergite with 2 hairs, upto 0.060 mm long, $1.8\times$ as long as basal diameter of antennal segment III. Siphunculi distinct, poriform with thick rim. Cauda with 2 hairs. Legs pale, nearly smooth, bearing many fine hairs, (0.026-0.056 mm) longest one on hind tibiae, 0.066 mm long, nearly twice as long as the diameter of the middle of the tibia ; first tarsal segments at least with 2, 2, 2 fine hairs ; dorso apical hairs on 2nd tarsal segments flatted at apices.

Colour : Pale brownish in life.

Measurements in mm. :

Length		Width		Antenna	
0.64		0.34		0.053	
Antennal segments				urs	ht ₂
I	II	III	IV		
0.033	0.033	0.050	(0.046+0.023)	0.050	0.093

(ex Poaceae, Old Barapani, Meghalaya, 17.viii.1973, ZSI).

Alate viviparous female : Body 1.8-2.2 mm long, with 0.70-1.10 mm as maximum width. Head with a pair of small protuberances ; cephalic hairs short, fine, 0.02-0.03 mm long, at most equal to the basal diameter of antennal segment III. Antennae 5-segmented, $0.35-0.50\times$ as long as the body, (mostly $0.40-0.45\times$) ; segment II and flagellum with close spinular imbrications ; hairs on antennae very sparse, short, upto 0.016 mm long, $1.2\times$ as long as the basal diameter of antennal segment III ; segment III with 21-24, IV with 8-14, V with 9-12 annular secondary rhinaria ; processus terminalis $0.11-0.23\times$ as long as base of last antennal segment. Rostrum reaches little beyond forecoxae, ultimate rostral segment $0.50\times$ to $0.76\times$ as long as second segment of hind tarsus. Abdominal dorsum pale, with pale brown to darker sclerotic bands on 7th and 8th tergites ; hairs on the dorsum of abdomen fine, 0.016-0.036 mm long, $1.1-2.7\times$ as long as the basal diameter of antennal segment III ; 8th tergite with 6 hairs, upto

0.030-0.036 mm long. Siphunculi ring-like with chitinized rims. Cauda with 10-15 hairs. Subanal plate bilobed, with 9-10 hairs on each lobe. Legs pale brown with apices of femora, tibiae and tarsi brown ; hairs on femora and tibiae 0.016-0.026 mm long, longest one on hind tibiae, 0.026 mm long, equal to the diameter at the middle of the tibia ; first tarsal segment with 4, 3, 2 hairs. Forewings with media once branched, cubitus and anal united at base ; hindwings with both obliques.

Colour : Pale brown in life.

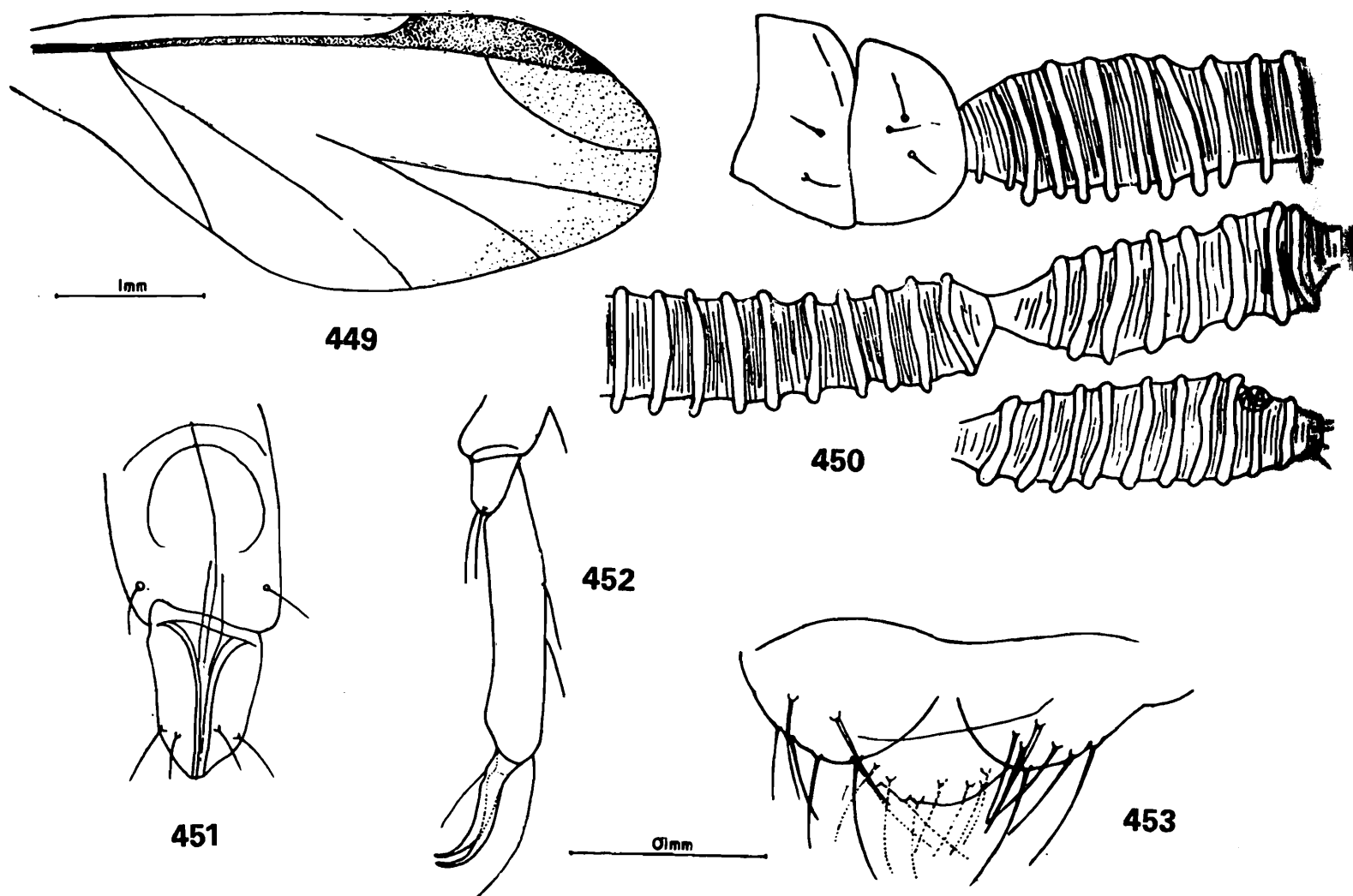
Measurements in mm :

	Length	Width	Antenna	
1.	1.93	1.01	0.79	
2.	1.03	0.82	0.74	
3.	1.79	0.82	0.73	
III	Antennal segments			ht ₂
	IV	V	urs	
0.31	0.19	(0.17+0.02)	0.65	0.10
0.29	0.14	(0.13+0.03)	0.65	0.12
0.29	0.18	(0.17+0.02)	0.76	0.10

(1, 3, ex Poaceae, Old Barapani, Meghalaya, 6.vi.1971, ZSI ; 2, ex. *Oplismenus* sp., Kohora, Kaziranga, Assam, 18.xii.1972, ZSI).

Nymphs : Not available.

Material examined : Many apterous and alate viviparous females from grass, Bhalukpong, Kameng district, Arunachal Pradesh, India, 2.xii.1969, coll. H. Banerjee (C.U.) ; 11 apterous viviparous females, from Poaceae, Kalimpong, West Bengal, India, 9.iii.1970, coll. M. R. Ghosh (C.U.) ; 5 alate viviparous females, 3 apterous viviparous females from *Oplismenus* sp., Kohora, Kaziranga, Assam, India, 16.vii.1972, coll. A.K. Ghosh (ZSI) ;



Alate viviparous female : 449, forewing ; 450, antenna ; 451, ultimate rostral segment ; 452, hind tarsus ; 453, caudal region.

8 alate viviparous females from Poaceae, Old Barapani ; Meghalaya, India, 6.vi.1973, coll. A. K. Ghosh (ZSI) ; 24 apterous viviparous females from Poaceae, Old Barapani, Shillong, Meghalaya, 17.viii. 1973, coll. A. K. Ghosh (ZSI).

Discussion : M. R. Ghosh *et al.* (1974) while describing the genus *Neoceratovacuna* with *O. panicola* (spelt *panicicola* in the description) as type species mentioned that one might be inclined to consider the species under either *Pseudoregma* Doncaster (type *bucktoni*) or *Paraoregma* M. R. Ghosh *et al.* (type *O. alexanderi* Takahashi) but the absence of distinct wax gland groups on the posterior part of the body in the former and mixed dorso-apical hairs on second tarsal segment in the latter, do not justify such

an inclusion of this species in either of the genera. The genus *Pseudoregma* as defined here and accepted earlier (Doncaster, 1966, Eastop and Hille Ris Lambers, 1976) provides a range of variability in both the above mentioned characters and as such, instead of having three different genera for three species, (*alexanderi*, *bucktoni*, *panicola*) as proposed by M. R. Ghosh *et al.* (1974) and followed by Raychaudhuri *et al.* (1980), inclusion of three species under one genus appears to be rational. The name *panicola* is considered valid as against *panicicola*, as the original description of Takahashi (1921) offers the same name and no subsequent proposal by Takahashi to modify the specific name, (except use of *panicicola* in 1958 without any discussion), is available.

The species was originally described from Taiwan, infesting *Panicum patens* during the months of November-January and occasionally in April. Cuttler (1953), while describing the species in details from New Zealand, mentioned its occurrence on *Oplismenus undulatifolia* during February-April and Eastop (1966) listed *Eleusine aristator* and *Setaria macrostachya* as its hosts in Australia. In the Indian region, its hosts include *Andropogon* sp., *Bambusa* sp., *Capillipedium assimilax*, *Eragrostis* sp., *Oplismenus compositus*, *Panicum* spp., and indet. grass and Bamboo, period of infestation being during the months of October to January and sometimes extending upto the month of March. The wax covered insects form dense colonies on leaves of the host plants or seed-heads of its host in the bush. M. R. Ghosh *et al.* (1974) noted ants attending the colonies of this species but David (1958) reported that ants do not attend these insects in South India. No natural enemy is known for this species.

Eastop (1966) stated that variation in the number of facets of wax glands is greater than indicated in most of the descriptions and until specimens have been reared under different conditions, the separate identity of number of similar species is suspected ; similar variation of number of facets or cells has also been noted in extensive material from Indian region, examined during the present study.

Distribution : India : Sikkim, West Bengal, Meghalaya, Manipur, Arunachal Pradesh and Tamil Nadu ; Mauritius ; Formosa ; Japan ; Australia ; New Zealand ; Africa ; Puerto Rico ; Cuba.

Types : Probably deposited in the collections of Agricultural Research Institute, Taipei, Taiwan.

Genus 26. *Tuberaphis* Takahashi

1933. *Tuberaphis* Takahashi, R. *Stylops*, 2 : 27 ; Raychaudhuri, D.N., Ghosh, M.R., Pal, P.K., and Ghosh, A.K., 1980. In Aphids of North East India and Bhutan, 393 ; Type species : *Tuberaphis coreanus* Takahashi.
1980. *Neotuberaphis* Pal, P.K. and Raychaudhuri, D.N. In Aphids of North East India and Bhutan, 383 ; Type species : *Neotuberaphis bengalensis* Pal and Raychaudhuri.

Morphology : Body oval, sclerotic. Head fused with prothorax, with 3 frontal tubercles, of which each of the lateral ones with a spine-like hair ; median tubercle divided by a suture and bearing a pair of similar hairs. Antennae 5-segmented, about one third the length of body ; flagellum with spinulose imbrications ; processus terminalis less than half the length of last segment ; primary rhinaria little protuberant and feebly ciliated. Eyes of 3 facets. Rostrum reaches mid-or hind-coxae, ultimate rostral segment, short, blunt and with a pair of accessory hairs. Meso-and Meta-notum distinct. Abdominal dorsum sclerotic, basal segments may be fused or all segments may be distinct. Dorsal hairs long, fine, or thick, arising from prominent bases ; 8th tergite with 4 hairs. Wax glands arranged in a row along the margin except between the antennae ; besides, irregularly scattered cribiform wax pores may be present on intersegmental areas of abdomen. Siphunculi surrounded by a few hairs. Cauda transversely oval, constricted at base and with a pair of long hairs. Subanal plate bilobed. Legs short, trochanters fused with femora ; first tarsal segments with 4, 4, 2 hairs, or 3, 3, 3 hairs ; dorso-apical hairs on second tarsal segment expanded at apices ; empodial hairs of similar apices, longer than claws.

Discussion : Takahashi (1933) described the nominate genus on the basis of a single new species *coreanus* feeding on *Viscum* sp. separating it from *Cerataphis* Licht., by the presence of 3 tubercles on frons, absence of wax glands between antennae and by the pronotum distinctly separated from mesonotum. Takahashi (op. cit) however mentioned, while describing the genus, "basal abdominal segments fused together" Ghosh, A.K., et al. (1971)

described an endemic species from North East India, viz., *T indica* which agrees in all generic characters as defined by Takahashi ; Ghosh, *et al.* (op. cit) also suggested inclusion of *Oregma loranthei* v.d. Goot, 1917 which feeds on *Loranthus* under *Tuberaphis* as it agrees fairly well with generic diagnosis. Eastop and Hille Ris Lambers (1976) listed all the above named species under *Tuberaphis* and added *Astegopteryx loranthei* Tseng and Tao, 1938. As Hille Ris Lambers (op. cit) indicated, possession of material of all the 4 species, *loranthei* (v.d. Goot) and *loranthei* (Tseng and Tao) must be regarded as separate species ; a new name for *loranthei* Tseng and Tao appears desirable and *loranthicola* is proposed here to replace *loranthei* of Tseng and Tao.

Ghosh, A.K. (1978) recorded a *Tuberaphis* from *Loranthus* and used the name *loranthei* (v. d. Goot). Pal and Raychaudhuri (1980) described a new genus *Neotuberaphis* with a new species *bengalensis* from an unidentified parasitic plant separating it from *Tuberaphis* by the presence of distinct abdominal segmentation and cribiform wax pores ; on reexamination of *Tuberaphis loranthei* (v. d. Goot) *sensu* Ghosh, 1978, *N. bengalensis* Pal and Raychaudhuri appears to be the same species. As such, *bengalensis* may be regarded as a synonym of *loranthei* (v. d. Goot) and the genus *Neotuberaphis* as a synonym of *Tuberaphis*.

Raha and Raychaudhuri (1981) described another species *indica* under *Neotuberaphis* for which a new name *breviseta* is proposed here, *indica* being preoccupied in *Tuberaphis*. Of the 5 species, three are known from parasitic plants except *indica* which is reported to feed on unidentified trees and *breviseta* is recorded from *Eugenia*. The presence of 3 tubercles, marginal wax glands, long hairs, and association with parasitic plants makes the members of this genus as a distinct group from other related genera.

Biology ; *T coreanus* feeds on *Viscum coloratum* (Loranthaceae) parasitic on other trees, while *T loranthei* (v. d. Goot) and *T lorantheicola* (Tseng & Tao) feed on *Loranthus* spp. *T indica* is reported to feed on leaves of unidentified tree and *T breviseta* on *Eugenia* sp. All the records indicate infestation during the months of January to May. All the species appear to be anholocyclic and monoecious in nature.

Distribution : India ; China ; Korea ; Java.

Type species : *Tuberaphis coreanus* Takahashi ; deposited in the Taiwan Agricultural Research Institute, Taipei, Taiwan.

Key to the species of *Tuberaphis* S. I.

Apterous viviparous female :

1. Body large 2.6-2.7 mm long. Marginal hairs on abdomen fine, upto 0.076 mm long. 8th tergite with fine hairs, upto 0.066-0.070 mm long. Antennal segment III 0.26-0.28 mm long, bearing fine hairs. Pale intersegmental areas hardly discernible on anterior tergites. Ultimate rostral segment 0.13 -0.14 mm long. . *T. indica* A. K. Ghosh, M. R. Ghosh and Raychaudhuri

Body small 1.3-1.9 mm long. Marginal hairs variable. Body pale or dark .2

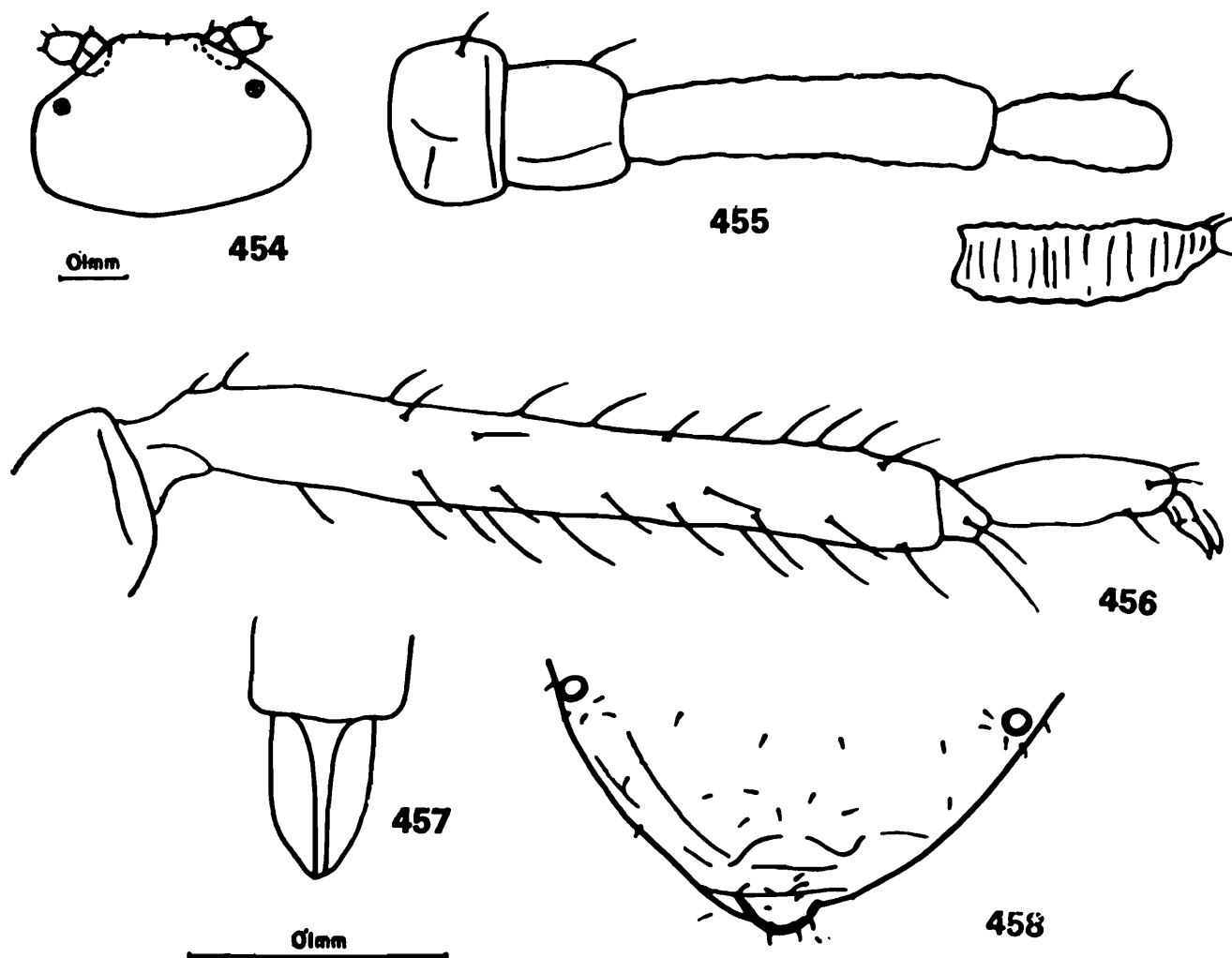
2. Marginal hairs on abdomen very small, upto 0.013-0.016 mm long. Abdominal dorsum pale with indistinct wax glands. Hairs on legs 0.006-0.015 mm long. Ultimate rostral segment without any accessory hairs . *T. breviseta* nom. nov.

Marginal hairs on abdomen upto 0.100 mm long and hairs on 8th tergite upto 0.117 mm long. Abdominal dorsum dark with distinct marginal wax glands. Hairs on legs upto 0.033-0.040 mm long. Ultimate rostral segment with 2 accessory hairs . *T. loranhi* (v. d. Goot)

63. *Tuberaphis breviseta* nom. nov.
(Figs. 454-464)

1981. *Neotuberaphis indica* Raha, S.K. and Raychaudhuri, D.N., *Entomon.*, 6 (4) : 320.

Apterous viviparous female : Body oval, pale brown 1.3-1.5 mm long with 1.0-1.2 mm as maximum width. Head fused with prothorax, with a pair of tubercles, each bearing a thick spine (0.010 mm



Tuberaphis breviseta (Raha & Raychaudhuri). Apterous viviparous female : 454, head ; 455, antenna ; 456, part of hind leg ; 457, ultimate rostral segment ; 458, position of abdomen.

long) on either side of a median suture, besides a pair of similar tuberculate spines placed antero-laterally ; dorsal cephalic hairs with acuminate apices upto 0.010-0.013 mm long, $0.50-0.60\times$ as long as the basal diameter of antennal segment III. Antennae 5-segmented, $0.32-0.35\times$ as long as the body ; antennal hairs sparse, 0.013-0.016 mm long, $0.50-0.70\times$ as long as the basal diameter of antennal segment III ; flagellum with spinulose imbrications ; processus terminalis $0.16-0.20\times$ ($0.28-0.33\times$) as long as the base of last antennal segment. Rostrum reaches little beyond mid-coxae, ultimate rostral segment upto $0.66-0.72\times$ as long as second segment of hind tarsus and without any accessory hairs. Abdominal segments 1-6 appear consolidated, hairs on the dorsum of abdomen upto 0.013-0.016 mm long, $0.70-0.75\times$ as long as the

basal diameter of antennal segment III. Wax glands indistinct, hardly discernible along the margin of the body along the postero-lateral part of cephalothorax to 7th abdominal segment. Siphunculi with large pores and with thin apical rims. Cauda transversely oval with 2 long hairs. Legs short, hairs on femora and tibiae, 0.006-0.015 mm long ; dorso-apical hairs on second tarsal segments expanded at apices ; first tarsal segments with 4, 4, 2 hairs.

(figures within parenthesis from original description).

Colour : Dark brown in life.

Measurements in mm :

	Length	Width	Antenna	
1.	1.47	1.0	0.49	
2.	1.38	1.0	0.52	
	Antennal segments			
III	IV	V	urs	ht ₂
0.18	0.07	(0.09+0.02)	0.01	0.096
0.18	0.08	(0.10+0.02)	0.06	0.073

(1, 2, ex. *Eugenia* sp., Ghaspani, Nagaland, 13.v.1978, C.U.).

Alate viviparous female : (description based on Raha and Raychaudhuri, 1981, and one damaged alate specimen). Body 1.35-1.60 (1.47) mm long with 0.67-0.79 mm as maximum width. Head dark brown with a distinct median suture and reduced tubercles (not evident in specimen examined) ; dorsal cephalic hairs very short, up to $0.41-0.51 \times$ as long as the basal diameter of antennal segment III. Antennae 5-segmented, $0.50-0.55 \times$ as long as the body ; flagellum with spinulose imbrications and bearing secondary annular rhinaria on segment III ((27-29), IV (8-10) and V (7-8) ; hairs on the flagellum short, similar to those on cephalothorax ; processus terminalis $0.20 \times$ as long as base of last antennal segment. Ultimate rostral segment $0.68-0.73 \times$ as long as second segment of hind tarsus. Abdominal dorsum pale with distinct

brown transverse spino-pleural bands on 7th and 8th tergites ; hairs on the dorsum, 0.010-0.016 mm long, up to 0.50× as long as the basal diameter of antennal segment III ; 8th tergite with 4 hairs. Siphunculi poriform. Cauda transversely oval. Subanal plate bilobed with about 12 hairs. Subgenital plate with about 10-11 hairs. Legs dark brown ; hairs on femora and tibiae upto 0.023 mm long ; first tarsal segments with 4, 4, 2 hairs ; empodial hairs longer than the claws. Forewings with media once branched ; hindwings with both oblique.

Colour : Dark brown in life with paler abdomen.

Measurements in mm :

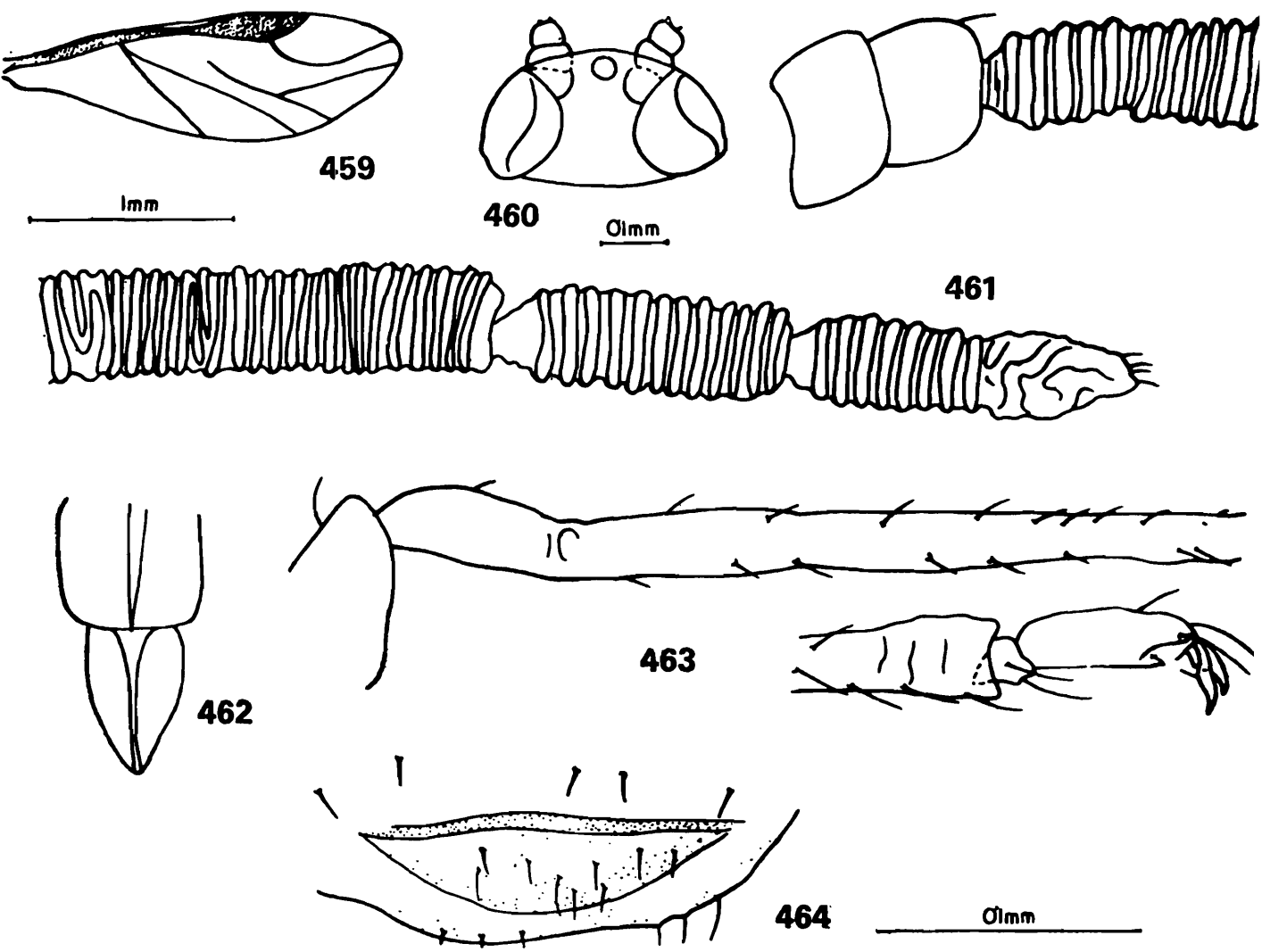
	Length	Width	Antenna	
1.	1.47	0.79	0.49	
2.	1.60	0.69	?	
	Antennal segments			
III	IV	V	urs	ht ₂
0.34	0.12	(0.15+0.03)	0.058	0.08
?	?	?	0.066	0.09

(1, 2, ex *Eugenia* sp., Ghaspani, Nagaland, 13.i.1978. C.U.).

Sexual forms : Not known.

Nymphs (damaged ; alate) : Body pale. Antennae pale, 5-segmented ; segment II with 2 hairs, 0.006-0.010 mm long ; processus terminalis 0.25× as long as base of last antennal segment. Rostrum reaches at least midcoxae, ultimate rostral segment 0.66× as long as second segment of hind tarsus and with only pre-apical hairs. Abdominal dorsum pale ; dorsal hairs short, sparse, 0.010-0.016 mm long. Legs pale with fine hairs upto 0.083 mm long ; first tarsal segments with 4, 4, 2 hairs ; dorso apical hairs on second tarsal segments flattened at apices. Wings buds distinct.

Colour : Not recorded ; probably pale in life.



Alate viviparous female : 459, forewing ; 460, head ; 461, antenna ; 462, ultimate rostral segment; 463, part of hind leg ; 464, caudal region.

Measurements in mm :

Length			Width		Antenna	
?			0.15		0.50	
Antennal segments					urs	ht ₂
I	II	III	IV	V		
0.03	0.03	0.20	0.09	(0.12+0.03)	0.06	0.09

(ex *Eugenia* sp. Ghaspani, Nagaland, 13.v.1978, C.U.).

Material examined : 6 apterous viviparous females, one alate viviparous female and one nymph, *Eugenia* sp., Ghaspani, Nagaland, India, 13.v. 1978, coll. S. Raha (Types ; C.U.).

Discussion : The name *indica* being preoccupied, by *T. indica* A.K. Ghosh, *et al.* 1971, a new name *breviset*a is proposed. The present species can easily be separated from *indica* by smaller size of body ; colouration, host association, ratio of antennae to body and dorsal hairs to basal diameter of antennal segment III, absence of wax glands on 8th tergite and from *loranthi* (= *bengalensis*) by the short hairs and ratio of ultimate rostral segment to second segment of hind tarsus.

Distribution : India : Nagaland.

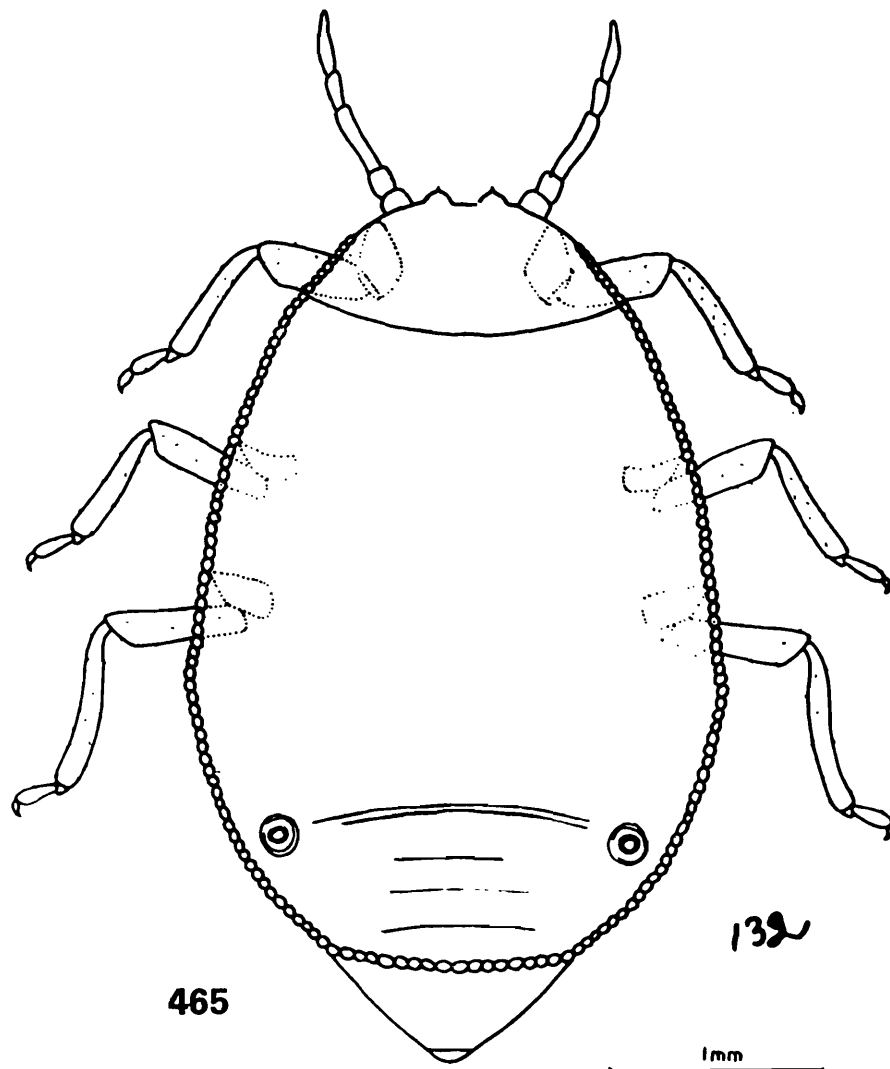
Types : In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, Calcutta, India.

64. *Tuberaphis indica* Ghosh, Ghosh and Raychaudhuri
(Figs. 465-468)

1971. *Tuberaphis indica* Ghosh, A.K., Ghosh, M.R., and Raychaudhuri, D.N. *Orient Insects*. 5 : 331.

1980. *Tuberaphis indica*, Raychaudhuri, D.N., Ghosh, M.R., Pal, P.K., and Ghosh, A.K. *In Aphids of North east India and Bhutan*, 394.

Apterous viviparous female : Body 2.4-2.7 mm long with 1.7-1.9 mm as maximum width. Head fused with prothorax, bearing a pair of ovoid frontal tubercles each of which bears a short, thick, dagger-shaped spine (0.01 mm) ; in between the paired tubercles, arise two similar spines from slightly raised tubercles, bases of which are confluent, thus apparently giving the appearance of three tubercles with a total of 4 dagger-shaped spines. Antennae 5-segmented, dark brown, $0.25\times$ as long as the body ; flagellum with distinct spinulose imbrications on segment III-V ; hairs on the flagellum very sparse, fine, 0.023-0.026 mm long, at most $0.80-0.85\times$ as long as basal diameter of antennal segment III ; processus terminalis $0.20-0.25\times$ as long as last antennal segment. Rostrum long, stout, reaches beyond midcoxae, ultimate rostral segment equal in length to second segment of hind tarsus and



Tuberaphis indica Ghosh, Ghosh and Raychaudhuri. Apterous viviparous female : 465, whole body.

bears a pair of accessory hairs. Abdominal dorsum sclerotic with segment 1-7 fused together ; hairs on the dorsum of abdomen fine, 0.046-0.062 mm long, 1.0-1.3 $\times$ as long as the basal diameter of antennal segment III ; 8th segment separated from the rest, broadly rounded ; wax gland cells present on anterio-lateral side of cephalothorax (12-14 on each side), marginally on meso- and meta-thorax (7-9 on each side) and fused abdominal segments 1-7 (35-40 on each side) ; 8th tergite with 15-17 wax gland cells. Siphunculi broad, placed on shallow cones, bearing 7-8 fine hairs. Cauda broadly rounded, constricted basally, with more than 20 long stout hairs. Subanal plate bilobed, bearing many long stout

hairs. Legs dark brown, stout, bearing many fine hairs (0.040-0.050 mm long), longest one on hind tibiae 0.50 mm long, 0.80-0.83 $\times$ as long as the diameter at the middle of the tibi ; tarsi sparsely imbricated, somewhat spinulose ; first tarsal segments with 3, 3, 3 hairs ; dorso-apical hairs on second tarsal segments expanded at apices.

Colour : Dark brown dorsally and pale yellow ventrally.

Measurements in mm :

	Length	Width	Antenna
1.	2.6	1.9	0.66
2.	2.4	1.7	0.70

Antennal segments			urs	ht ₂
III	IV	V		
0.25	0.09	(0.013+0.03)	0.13	0.13
0.28	0.14	(0.13+0.04)	0.14	0.15

(1, 2, ex unidentified tree, Algarah, West Bengal, 11.ii.1969, C.U.).

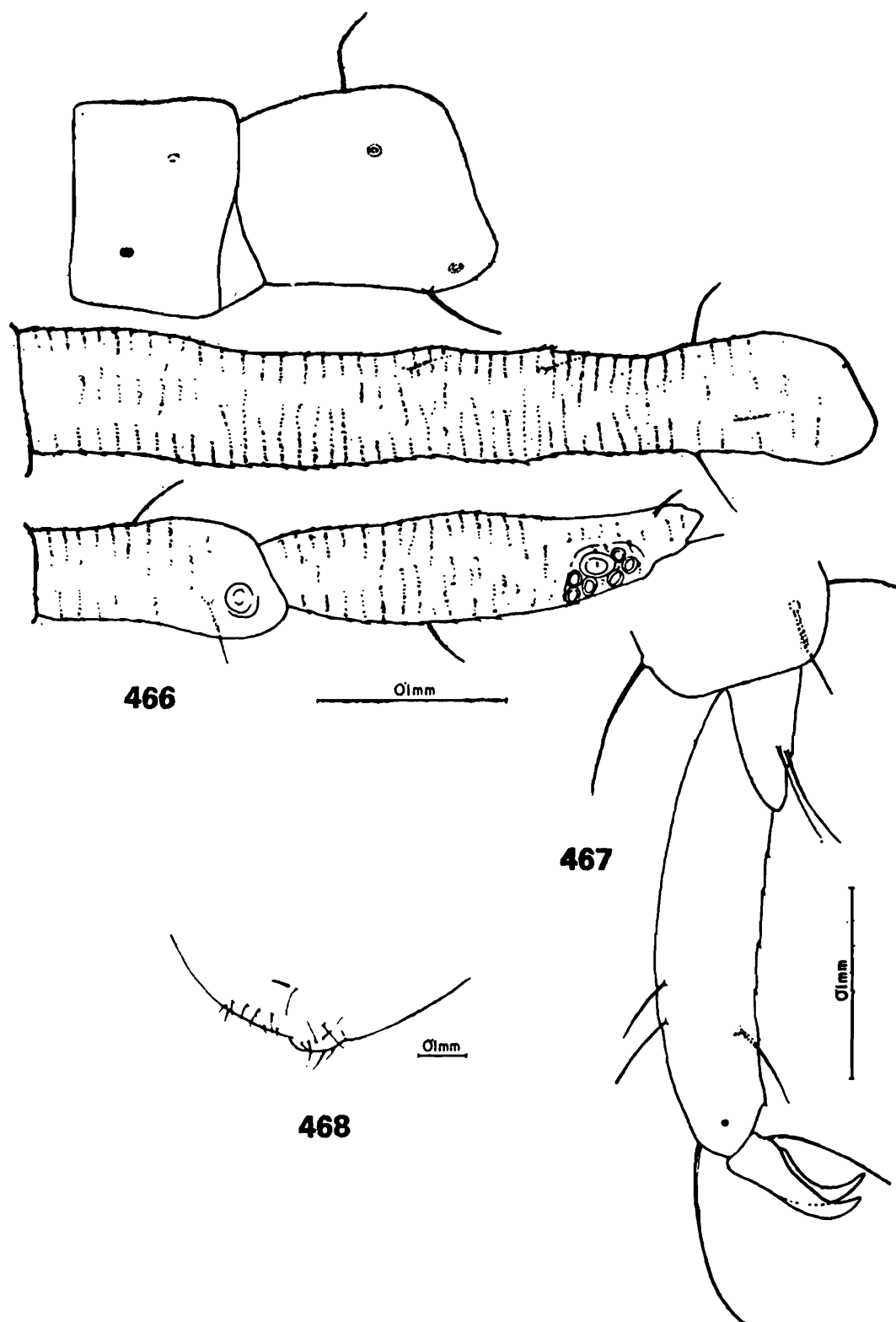
Alate viviparous female : Not known.

Nymphs : Not available.

Material examined : 10 apterous viviparous females from an unidentified tree, Algarah and Kurseong, Darjeeling district, West Bengal, India, 11.ii.1969 and 2.ii.1970, respectively (Holotype and Paratypes), coll. S. D. Chakrabarti (C. U. Colls.)

Discussion : Ghosh, A. K. *et al.* (1971) mentioned about the differences to separate *coreanus* Takahashi, type species of *Tuberaphis*, from *indica* Ghosh, A. K. *et al.* These insects form dense colonies on branches or on new vegetative buds of unidentified host-plant (? Rosalceae) and remain covered with white waxy secretion.

Distribution : India : West Bengal.



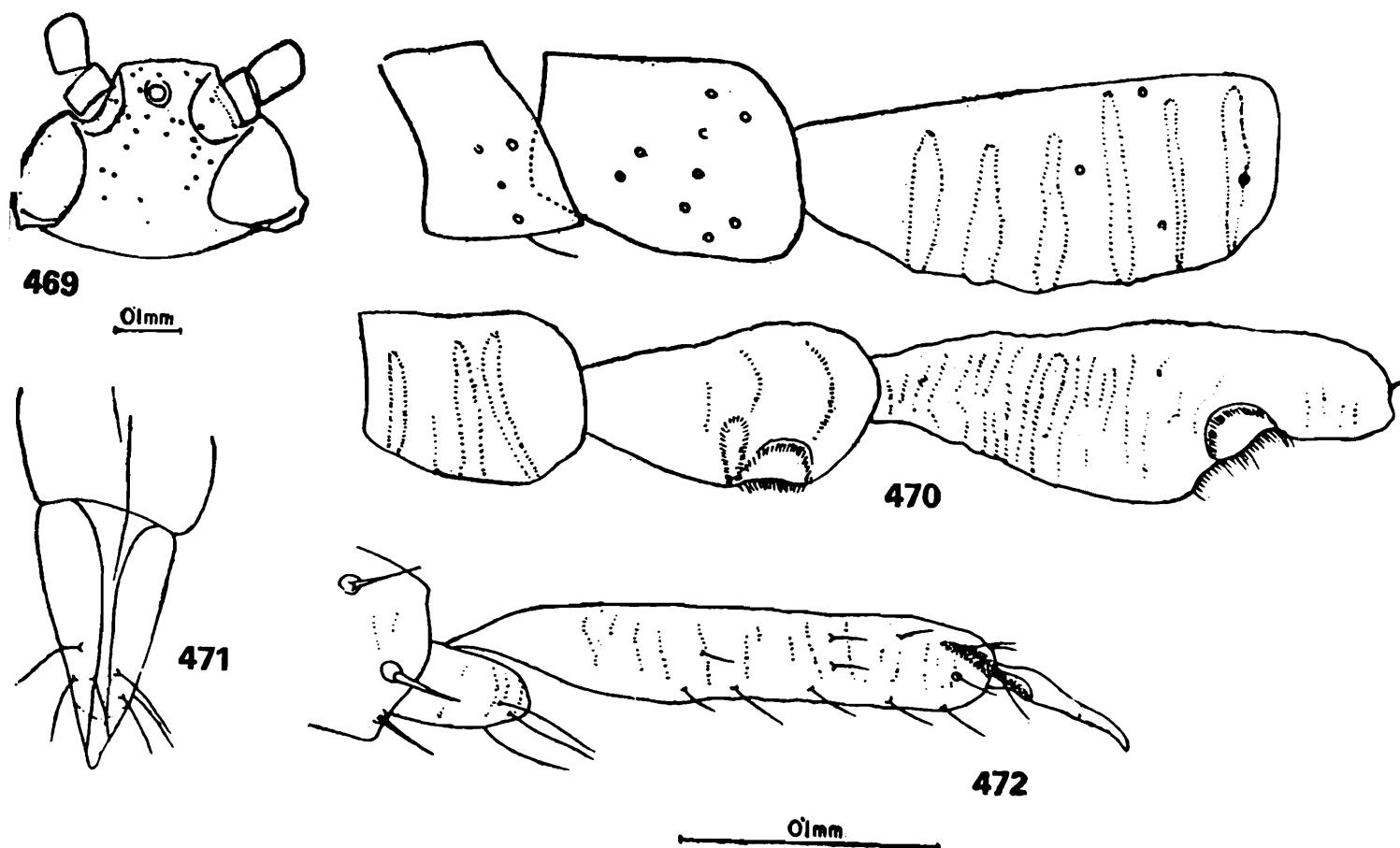
Apterous viviparous female : 466, antenna ; 467, hind tarsus ; 468, caudal region.

Types : In the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India.

65. *Tuberaphis loranthi* (van der Goot)
(Figs. 469-480)

1917. *Oregma loranthi* van der Goot, P., *Contrib. Fauna Indes. Neerl.*, 1 (3) : 194-196.
 1971. *Tuberaphis loranthi* Ghosh, A.K., Ghosh, M.R., and Raychaudhuri, D.N., *Orient. Ins.*, 5 (3) : 332.
 1976. *Tuberaphis loranthi*, Eastop, V.F., Hille Ris Lambers, D., *Survey of the World's Aphids*, 439.
 1978. *Tuberaphis loranthi* Ghosh, A.K., *Orient. Ins.*, 12 : 101.
 1980. *Neotuberaphis bengalensis* Pal, P.K. and Raychaudhuri, D.N. *In* *Aphids of North East India and Bhutan*, 384, 449.

Apterous viviparous female : Body brown to dark brown, 1.70-1.90 mm long, 1.20-1.22 mm as maximum width, bearing a row of marginal wax gland cells from cephalothorax to 7th abdominal tergite. Head fused with prothorax and bearing a median tubercle and two lateral frontal tubercles, the former being divided by a



Tuberaphis loranthi v.d. Goot. Apterous viviparous female : 469, head ; 470, antenna ; 471, ultimate rostral segment ; 472, hind tarsus.

median suture, each lateral tubercles bears a single spine and the median tubercle bears two stout spiny hairs ; dorsal cephalic hairs with acute apices, 0.04-0.07 mm (0.06-0.08 mm) long, $1.0-1.5\times$ ($1.40-1.55\times$) as long as the basal diameter of antennal segment III. Antennae 5-segmented, dark brown to nearly black, $0.25-0.30\times$ as long as the body ; segments I and II each with 2 flagellate hairs, 0.030 -0.040 mm long ; flagellum with distinct spinulose imbrications ; hairs on flagellum fine, 0.026-0.033 mm long, longest one on segment III, $0.75-0.80\times$ as long as the basal diameter of the segment ; processus terminalis at most $0.25\times$ ($0.40\times$) as long as base of last antennal segment. Rostrum reaches hindcoxae, ultimate rostral segment $0.85-0.95\times$ as long as second segment of hind tarsus and bears a pair of accessory hairs, tergum dark brown ; abdominal segments 1st-4th laterally separated by intersegmental pale areas, 5th and 6th tergites fused together and lateral pale area extends to spino-pleural region ; 8th tergite distinctly separated from anterior tergites ; hairs on the dorsum of abdomen with fine apices ; each of 1st-6th abdominal tergites with 2 marginal, 1 submarginal, 1 pleural and 1 spinal hairs arranged in a transverse row on each side, these being 0.060-0.112 mm long, 2.1 ($1.85-1.45\times$) as long as the basal diameter of antennal segment III ; 7th tergite with 6 hairs and 8th tergite with 4 hairs. these being 0.085-0.115 mm long, $2.0-2.7\times$ ($2.0-2.40\times$) as long as the mentioned diameter. Irregular cribiform wax cells and wax pores present from cephalothorax to 7th abdominal tergite. Siphunculi with large pores surrounded by 5-6 hairs. Cauda with 2 hairs, Subanal plate bilobed bearing numerous long and stout hairs. Legs dark, short ; trochanters fused with femora ; femora and tibiae with short and long hairs, longest one on hind tibiae 0.033-0.040 mm long, at most equal to the diameter at the middle of the tibia ; first tarsal segments with 4, 4, 2 hairs ; dorso-apical hairs on second tarsal segment expanded at apices. (figures in parenthesis from original description, 1980).

Colour : Brōwnish in life.

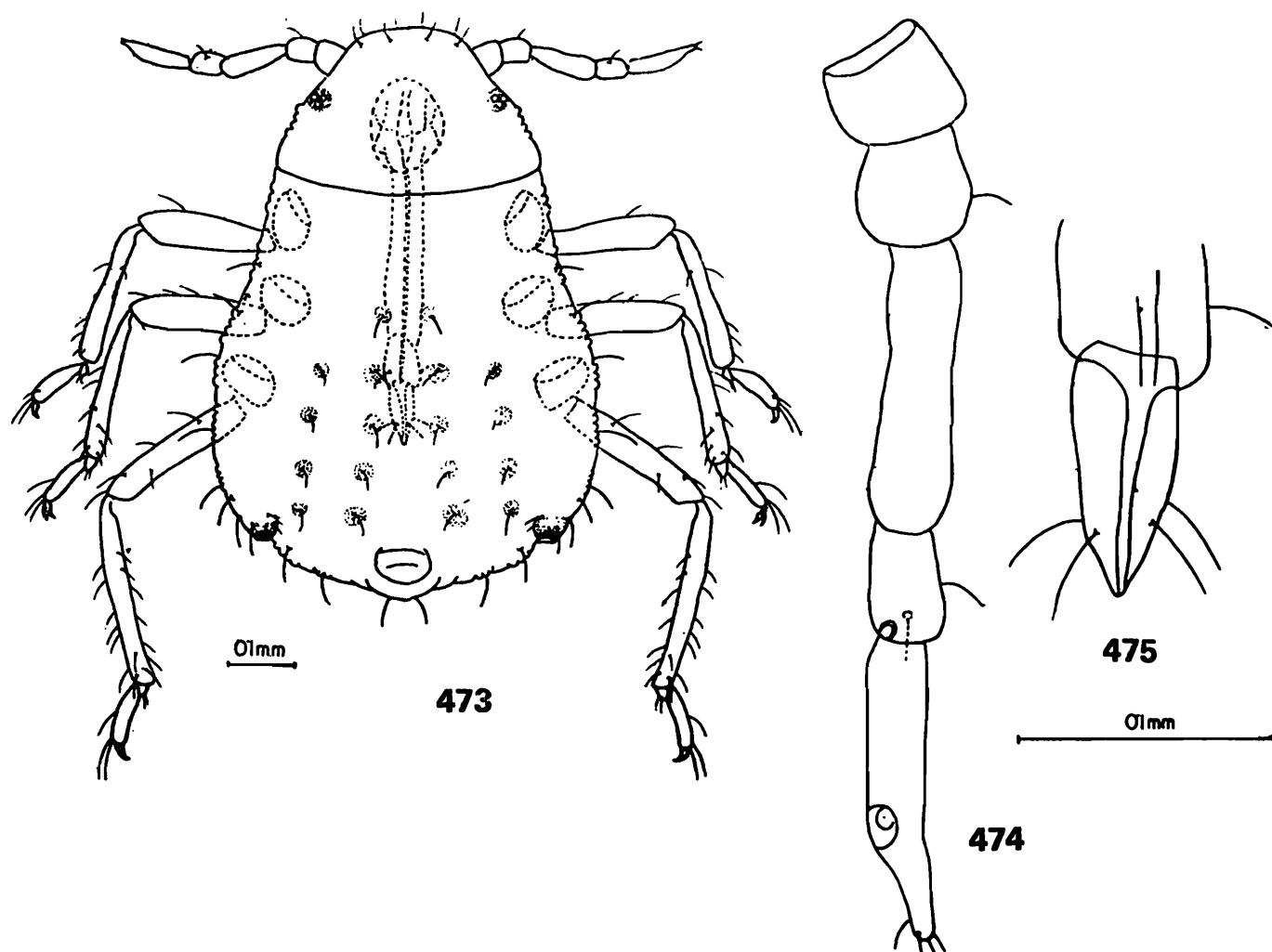
Measurements in mm :

	Length	Width	Antennae
1.	1.78	1.22	0.51
2.	1.76	1.19	0.48

Antennal segments			urs	ht ₂
III	IV	V		
0.19	0.06	(0.10+0.03)	0.11	0.13
0.18	0.06	(0.11+0.03)	0.11	0.13

(ex. Indet parasitic plant, Algarah, W.B., 11.v.1969, C.U.).

Nymph (Apterous : late stage) : Body 1.03 mm long with 0.60 mm as maximum width. Head and prothorax fused, dark brown, sclerotic, bearing 4 prominent stout hairs, 0.036-0.040 mm long, arising from tuberculate bases ; head with a distinct median ridge ; hairs on vertex sparse, fine, 0.033 mm long. Antennae dark brown, 5-segmented, (0.45 mm), $0.42\times$ as long as the body ; segments



Apterous nymph (late stage) : 473, whole body ; 474, antenna ; 475, ultimate rostral segment.

I, II, and IV subequal to one another ; hairs on flagellum fine, up to 0.023 mm long, and equal to the basal diameter of antennal segment III ; processus terminalis $0.40\times$ as long as base of last antennal segment. Rostrum reaches hindcoxae, ultimate rostral segment nearly equal to the second segment of hind tarsus. Abdominal dorsum pale, bearing distinct segmental paired, marginal, pleural and spinal scleroites on 1st-7th tergites, each bearing 1 (or rarely 2 on marginal ones) hair, 0.036-0.050 mm long, up to $1.9\times$ as long as basal diameter of antennal segment III. Wax gland cells present in a row, segmentally all along the lateral margin from postero-lateral part of cephalothorax to 7th abdominal tergite ; 8th tergite with 2 fine hairs upto 0.053 mm long. Siphunculi on brown sclerotic cones bearing 4-5 hairs. Cauda with 2 long hairs (0.066 mm) and 2 shorter hairs. Legs concolourous with antennae, bearing fine hairs on femora and tibiae which are 0.040-0.046 mm long, longest one on hind tibiae upto $1.2\times$ as long as the diameter at the middle of the tibia ; first tarsal segments with 4, 4, 2 (?) hairs.

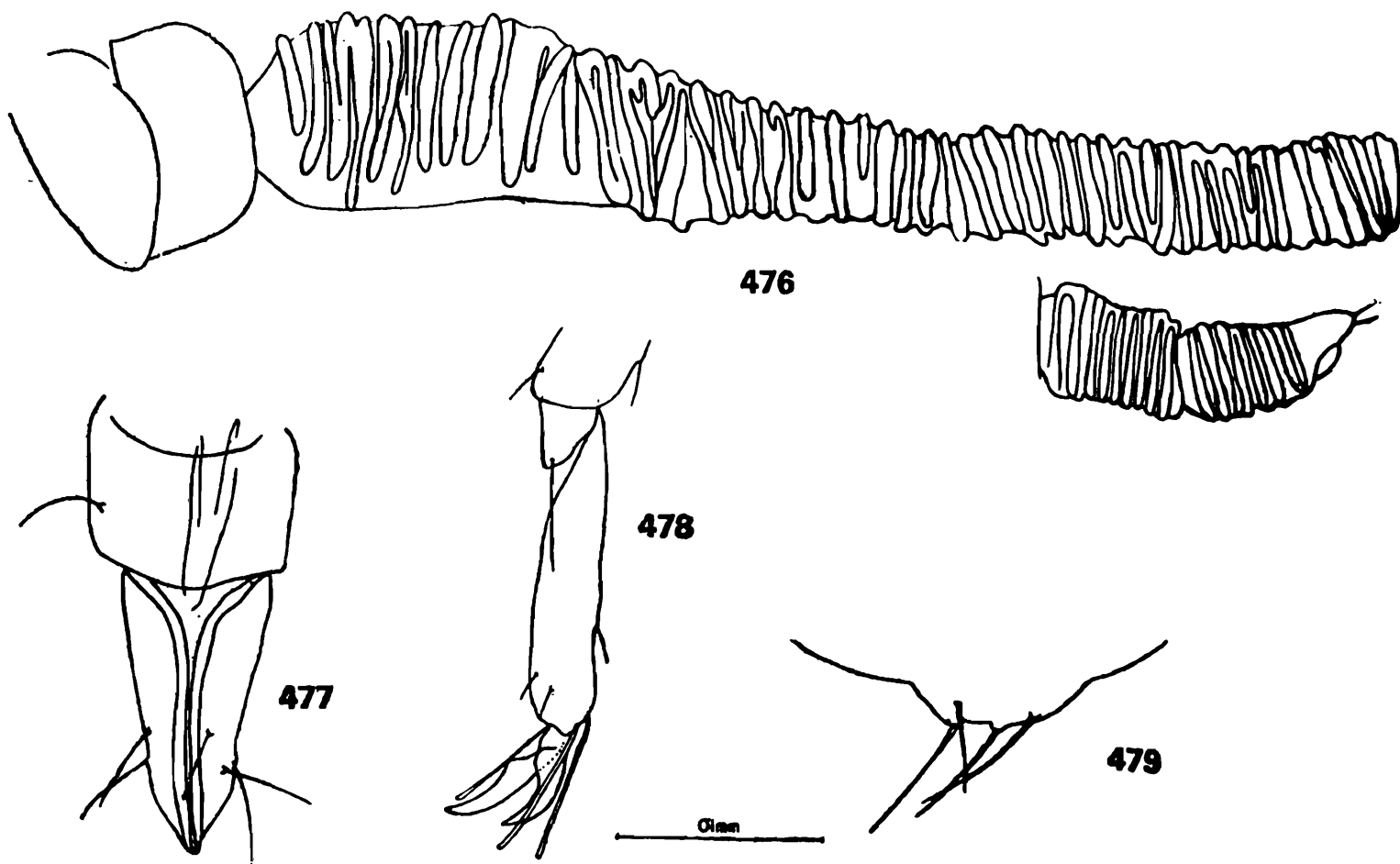
Colour : Dark brown or dirty brown in life.

Measurements in mm :

Length		Width	Antenna	
10.3		0.60	0.43	
Antennal segments			urs	ht ₂
III	IV	V		
0.12	0.04	(0.10+0.04)	0.106	0.115

(ex *Loranthus* sp., Shillong, Meghalaya, 26.i.1975, ZSI).

Alate viviparous female : (Much damaged) : Body elongate oval. Antennae 5-segmented ; segment III longest with over 40 annular secondary rhinaria ; segments IV and V subequal with 10-13 similar rhinaria. Dorsum with numerous wax pores on abdomen. Dorsal hairs fine ; lateral abdominal hairs up to 0.066-0.083 mm long ; 8th tergite with 4 hairs up to 0.083 mm long. Siphunculi with large pores. Legs slender, much longer than in



Alate viviparous female : 476, antenna ; 477, ultimate rostral segment.
478, hind tarsus ; 479, caudal region.

apterae ; hairs on femora and tibiae fine, longest one on hind tibiae 0.030 mm long, equal to the diameter at the middle of the tibia ; dorso-apical hairs flattened at apices.

Colour : Not recorded.

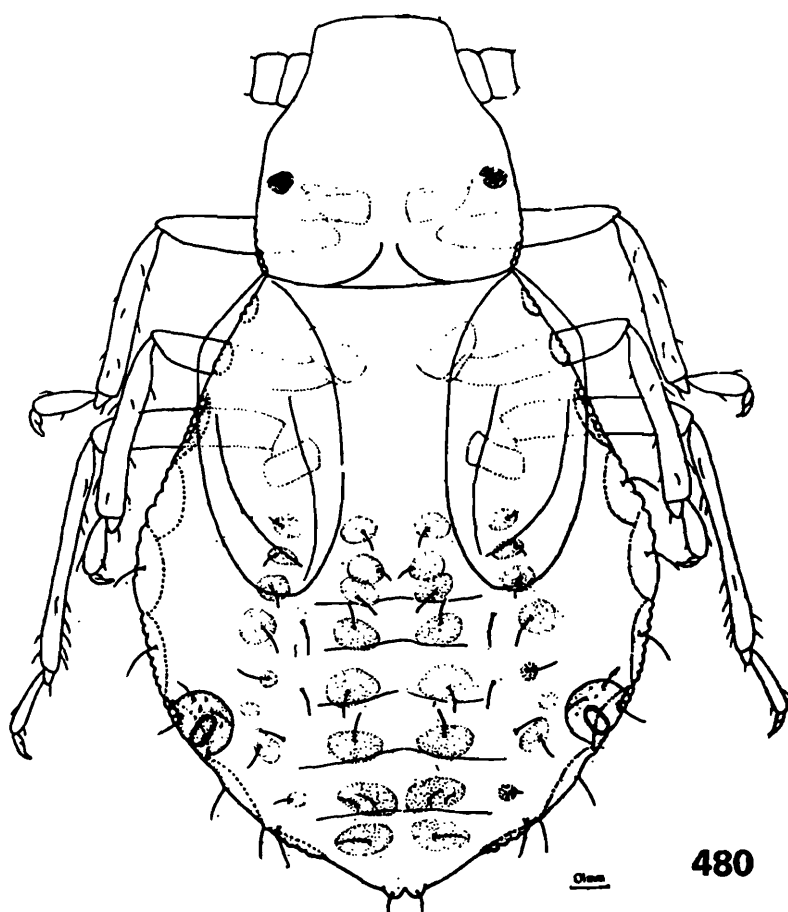
Measurements in mm : Due to non-availability of any good specimen, morphometric measurements from the one damaged specimen could not be given.

Sexual forms : Not known.

Material examined : Two apterous viviparous females, one alate viviparous female and 10 nymphs from *Loranthus* sp. on

Vitex, Shillong, Meghalaya, India, 26.i.1975, Coll. M.S. Jyrwa (Z.S.I.) ; two apterous viviparous females from an indet parasitic plant, Algarah, Darjeeling, 11.v.1969, Coll. M.R. Ghosh (types of *Neotuberaphis bengalensis* ; C. U. Colls.).

Discussion : The species appears to be rare as no reference to the species could be found after it was described from *Loranthus* in Java in 1917. Ghosh *et al.* (1971) first suggested inclusion of the species under *Tuberaphis* which was followed in Eastop and Hille Ris Lambers (1976). Ghosh, A. K. (1978) also recorded the species for the first time from India. Reexamination of material of *Neotuberaphis bengalensis* Pal and Raychaudhuri, described in 1980, reveals that the former is identical with *loranthi* (v.d. Goot) ; the original description of *bengalensis*, however is erroneous in the measurement of ultimate rostral segment and second segment of hind tarsus which can never be 0.48 and 0.53 mm.



Alate nymph : 480, whole body.

The dirty green to brownish insects form small or large colonies, covered with white waxy secretion and often cause marginal folds of leaves inside which the insects live. It is not known to be myrmecophilous.

Distribution : India : West Bengal, Meghalaya ; Indonesia ; Java.

Types : Location of types not known. Types of *Neotuberaphi bengalensis* Pal and Raychaudhuri are deposited in the collections of Entomology Laboratory, Department of Zoology, University of Calcutta, India.

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ADDENDA

Complete references for

- p. 168 : 1985. *Neothoracaphis qarhwalensis* Chakrabarti, S. and Raha, S., *Ann. Zool.* 39(3) : 90.
- p. 203 Ref : *Pseudothoracaphis* ; 1985 *Heminipponaphis* Chakrabarti, S. and Raha, S., *Ann. Zool.* 39(3) : 87.
- p. 206 Ref : *Pseudothoracaphis himachali* ; 1985 *Heminipponaphis querciphaga* Chakrabarti, S. and Raha, S., *Ann. Zool.* 39(3) : 88.

HOST PLANTS OF PHLEOMYZINAE,
ANOECINAE AND HORMAPHIDYNAE
IN INDIAN REGION

Bamboo (Indet Spp.)	Grass (Indet spp.)
<i>Aleurodaphis antennata</i>	<i>Anoecia himalayensis</i>
<i>Astegopteryx insularis</i>	<i>Anoecia radiciphaga</i>
<i>Astegopteryx minuta</i>	<i>Anoecia vagans</i>
<i>Astegopteryx neelgiriensis</i>	Grassum prothama
<i>Ceratoglyphina bambusae bengalensis</i>	<i>Ceratovacuna perglandulosa</i>
<i>Ceratovacuna indica</i>	Heteropananax fragrans
<i>Chaitoregma tattakana</i>	<i>Aiceona titabarensis</i>
<i>Glyphinaphis bambusae</i>	Holboellia latifolia
<i>Pseudoastegopteryx bambusae</i>	<i>Sinonipponaphis holboelliae</i>
<i>Pseudoregma alexanderi</i>	Ischemum album
<i>Pseudoregma bucktoni</i>	<i>Ceratovacuna spinulosa</i>
Bambusa arundinacea	Lauracene (Indet sp.)
<i>Astegopteryx bambusae</i>	<i>Aiceona retipennis</i>
<i>Ceratovacuna silvestrii</i>	Lindera sp.
Betula alnoides	<i>Metanipponaphis silvestrii</i>
<i>Hamamelistes miyabei</i>	Lindera pulcherrima
Calamus rotang	<i>Aiceona parvicornis</i>
<i>Cerataphis palmae</i>	Litsaea corymbosa
Castanopsis sp.	<i>Nipponaphis manoji</i>
<i>Parathoracaphis manipurens</i>	<i>Nipponaphis (P.) himalayensis</i>
Castanopsis histrix	Litsaea polyantha
<i>Metanipponaphis echinata</i>	<i>Aiceona robustiseta</i>
Castanopsis tribuloides	<i>Nipponaphis (P.) himalayensis</i>
<i>Metanipponaphis assamensis</i>	<i>Nipponaphis (P.) machiliphaga</i>
Cocos nucifera	Loranthus sp.
<i>Cerataphis palmae</i>	<i>Tuberaphis indica</i>
Compositae (Indet sp.)	Machilus sp.
<i>Aleurodaphis blumae</i>	<i>Sinonipponaphis monzeni</i>
Cornus stolonifera	Machilus odoratissima
<i>Anoecia corni</i>	<i>Aiceona (s.) manipurens</i>
Engelhardtia spicata	<i>Aiceona pseudosugii</i>
<i>Aiceona himalica</i>	Machilus villosa
Epidendron sp.	<i>Aiceona pallida</i>
<i>Cerataphis orchidearum</i>	Montana sp.
Eragrostis nigra	<i>Aleurodaphis blumae</i>
<i>Anoecia radiciphaga</i>	Oplismenus sp.
Eugenia sp.	<i>Pseudoregma panicola</i>
<i>Tuberaphis breviseta</i>	

Poaceae (Indet sp.)*Pseudoregma panicola***Poa nemoralis***Anoecia nemoralis***Populus sp.***Doraphis populi**Pheloemyzus passerini***Quercus spp.***Neothoracaphis sutepensis**Nipponaphis (P.) querciphaga**Parathoracaphisella indica**Reticulaphis distyli rotifera***Quercus dealbata***Indonipponaphis tuberculata**Thoracaphis querciphaga***Quercus incana***Neothoracaphis garhwalensis**Pseudothoracaphis himachali***Saccharum officinarum***Ceratovacuna lanigera**Ceratovacuna perglandulosa***Triticum sativum***Anoecia nemoralis**Anoecia vagans*

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Born in 1938 at Rourkela, Orissa, India, Dr. A. K. Ghosh had his education at the University of Calcutta and University of Wisconsin, Madison, U.S.A. He also started his research on Indian Aphidoidea first at the University of Calcutta in 1958 and continued the same till he left for U.S.A. in 1965 to work on a project on long-range dispersal of aphid-vectors of plant viruses, with a Fulbright Grant for higher studies at University of Wisconsin. On his return he resumed his work at the University of Calcutta in 1968 and subsequently at Zoological Survey of India from 1972. He has so far more than 160 research publications to his credit including 'Aphids of Economic Importance' (1974), 'Fauna of India : Aphidoidea' part 1 General Introduction and subfamily Chaitophorinae (1980), part 2 subfamily Lachninae (1982), 'Aphids parasitoids of India and adjacent countries' with P. Stary (1983), 'Fauna of India : Aphidoidea' part 3 subfamily Pemphiginae (1984), 'Oriental Aphidoidea' with B. K. Agarwala (1985), besides contributing to the multiauthored volume on 'Aphids of North East India and Bhutan' edited by D. N. Raychaudhuri (1980). His current interests include 'Biosystematics of Aphidoidea and their natural enemies' and 'Aphid-galls and Gall-aphids'. A member of several scientific societies, Dr. Ghosh is also associated with a number of Universities in Eastern India and has been acting as a visiting Guest lecturer in the University of Calcutta and other reputed institutions.